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352. ON THE MIOCENE PECTINIDAE FROM THE ENVIRONS OF SENDAI; PART 13, ON *PECTEN* (*PATINOPECTEN*) *PARAPLEBEJUS* NOMURA AND HATAI*

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仙台附近中新統産 Pectinidae; その 13, *Pecten* (*Patinopecten*) *paraplebejus* NOMURA and HATAI について: *Patinopecten paraplebejus* (NOMURA and HATAI) を再記載し, 更にその産状と地質学的な意義について簡単に述べた。特に地層が逆転していない場合でも, 小型の個々の殻が凸面を下にして, 地層面に並行に含まれていることがあることを指摘した。

増田孝一郎

Introduction and Acknowledgements

Pecten (*Patinopecten*) *paraplebejus*, first described by S. NOMURA and K. HATAI (1936) from the Miocene Tanagura formation at Okada, Tanagura-machi, Higashi-Shirakawa-gun, Fukushima Prefecture, was reported by them in the following year (1937) from the Miocene Nanakita formation at Matsumori, Izumi-machi, Miyagi-gun, Miyagi Prefecture. In the same year, S. NOMURA and N. ZINBO reported it from the Ginzan formation near the Hot Spring, Obanazawa-machi, Kita-Murayama-gun, Yamagata Prefecture. In 1954, T. SHIKAMA figured but without description, this species from the Miocene Awano formation of the Tomikusa group at Konakao, Ôshimojyô-mura, Shimo-Ina-gun, Nagano Prefecture. However, T. SHIKAMA figured a specimen referable to *Patinopecten yamasakii* (YOKOYAMA).

Recently, abundant topotype specimens of this species were collected from its type locality and the environs, and from the Ginzan formation near the Ginzan Hot Spring. Based upon these specimens and others preserved in the collections of the Department of Geology, Faculty of Education, and of the Institute of Geology and Paleontology, Faculty of Science, both of the Tohoku University, and of the Saito Ho-on Kai Museum, all in Sendai City, a redescription of the characters of this species and its relationship with related ones as well as the mode of occurrence and its geological significance are given in this article.

Acknowledgements are due to Dr. Kotora HATAI of the Department of Geology, Faculty of Education, Tohoku University, for kind supervision of the present article. Thanks are due to Mr. Kazuo TAGUCHI of the Institute of Petrology, Mineralogy and Economic Geology, Faculty of Science, Tohoku University, for his kind offer of the specimens which he collected from the Ginzan formation.

* Received April 8, 1958; read at the annual meeting of the Society at Sendai, Feb. 2, 1958.

Description

Family Pectinidae

Subfamily Pectininae

Genus *Patinopecten* DALL, 1898

Patinopecten paraplebejus
(NOMURA and HATAI), 1936

Pl. 1, figs. 1-6.

1936. *Pecten (Patinopecten) paraplebejus* NOMURA and HATAI, *Saito Ho-on Kai Mus., Res. Bull., No. 10*, p. 119, pl. 13, figs. 1, 2, pl. 16, figs. 6, 7.
1937. *Pecten (Patinopecten) paraplebejus* NOMURA and HATAI, *Ibid., No. 13*, p. 130, pl. 19, fig. 1.
1954. *Patinopecten* sp., HIRAYAMA, *Sci. Rep., Tokyo Kyoiku Daigaku, Sec. C, Vol. 3, No. 18*, p. 55, pl. 3, fig. 7.

The specimens studied enable the presentation of the following description.

Shell large, moderately thick, orbicular, equilateral except for auricles; right valve more convex than left; both valves radiately ribbed and forming an angle of about 100° at apex.

Right valve gently convex, with about 20, low, round-topped, smooth radial ribs and fine concentric growth lines; radial ribs much broader than their interspaces, rarely with a faint medial sulcus near submargins, and tend to become obsolete towards ventral margin; interspaces between radial ribs very shallow and smooth; auricles rather large; anterior auricle subequal to posterior, furnished with wide and shallow byssal notch, and ornamented by rather distinct concentric lines and several, fine, faint radial threads; posterior auricle similar to anterior in sculpture; hinge with rather distinct, simple cardinal crura, wide and deep resilial pit provided with rather distinct, nearly straight lateral ridges, and with ill-developed ctenolium in young shell. Left valve nearly flat or slightly convex, with round-topped, smooth radial ribs, and fine concentric growth lines; radial ribs much narrower than their interspaces and tend to become obsolete towards ventral margin; interspaces between radial ribs much broader than ribs themselves and rarely with a fine intercalary thread near submargins; auricles sculptured with several, fine radial threads and rather distinct concentric lines; wide and deep resilial pit provided with rather distinct sockets corresponding to lateral ridges of right valve. Interior surface of both valves rather smooth.

Dimensions (in mm.):—

Valve	Right	Right	Right	Left	Left	Left
Height	126	83	82	106	38	17
Length	127	82	—	108	37.5	15.5
Hinge-length	66	—	48	59	22.5	9
Depth	26	15.5	15	8	4	2
Apical angle	100°	100°	100°	100°	100°	100°

Comparison and Affinity:—This species resembles the Recent *Patinopecten yessoensis* (JAY) of Northern Japan, as pointed by S. NOMURA and K. HATAI (1936), but *P. yessoensis* is distinguishable therefrom by the radial ribs which tend to become obsolete towards the ventral margin, more convexity of the right valve, and several, fine, faint radial threads on the surface of auricles.

In *yessoensis* these are three, rather distinct radial threads, and in *P. paraplebejus* the hinge with a wide and deep resilial pit provided with distinct lateral ridges. As pointed by S. NOMURA and K. HATAI (1936), *Patinopecten plebejus* (YOKOYAMA) from the Pliocene Sawane formation, Sado Island, Niigata Prefecture, also resembles this species, but it differs from the present one by the greater number of radial ribs, somewhat smaller auricle and more conspicuous network on the surface of the left valve. *Patinopecten ibaragiensis* MASUDA (1953) from the upper Miocene formation below the Sukegawa Gas Company, Hitachi City, Ibaraki Prefecture, is distinguishable from the present one by the characters of radial ribs, more conspicuous cardinal crura, and a few, fine riblets between the radial ribs of the left valve.

Remarks:—This species is characterized by the large, orbicular, inflated right valve which is provided with 18 to 22, low, round-topped, smooth radial ribs which are much broader than their interspaces and tend to become obsolete towards the ventral margin, rather distinct and simple cardinal crura, wide and deep resilial pit provided with distinct lateral ridges, wide and shallow byssal notch, and the auricles which are sculptured with several, fine radial threads, and by the left valve which is nearly flat or slightly convex, and provided with narrow radial ribs which tend to become obsolete towards the ventral margin.

Depository:—Holotype, SM, Reg. No. 2649, paratype, SM, Reg. No. 2740.

Type locality, Geological formation and Age:—Okada, Tanagura-machi, Higashi-Shirakawa-gun, Fukushima Prefecture. Lat. 37°01′N., long. 140°26′30″E. Tanagura formation. Early Miocene.

Distribution;—Tanagura formation, Fukushima Prefecture; Kobana formation, Tochigi Prefecture; Nanakita formation, Miyagi Prefecture and Ginzan formation, Yamagata Prefecture; all Early Miocene in age.

Mode of Occurrence and Geological Significance

Abundant specimens of *Patinopecten paraplebejus* were collected from the rounded pebble or granule bearing very coarse-grained sandstone (about 100 cm. in thickness) at the type locality, associated with numerous shells as *Glycymeris yessoensis* (SOWERBY), *Chlamys kaneharai* (YOKOYAMA), *Mercenaria yokoyamai* (MAKIYAMA), *Dosinia kaneharai* YOKOYAMA, *Polinices didyma* (RÖDING), *Olivella iwakiensis* NOMURA and HATAI, *Tanakura tanakura* HATAI, etc. They occur as isolated and water worn valves and largely consist of adult specimens. Almost all of them are arranged nearly parallel with the bedding plane and with the convex side upwards.

Numerous young shells of *paraplebejus* occur as isolated valves from the coarse-grained sandstone (about 150 cm. in thickness) in a little higher horizon than the above mentioned near the type locality. These are associated with numerous small shells of *Glycymeris yessoensis*, *Crassatellites nanus* (ADAMS and REEVE), *Miyagipecten matsumoriensis* MASUDA, *Myadora ikebei* HABE, *Tanakura tanakura*, etc. Almost all of the *paraplebejus* and the other specimens are arranged parallel with the bedding plane and with the convex side downwards. The majority of them are water worn shells or sometimes fragments. They are usually concentrated within a given layer, and occur rather sporadically in the other layers, though they also ar-

ranged parallel with the bedding plane and with the convex side downwards.

Several isolated specimens of *paraplebejus* occur from the conglomeratic coarse-grained sandstone of the Tanagura formation at Nishigoto, Hanawa-machi, Higashi-Shirakawa-gun, Fukushima Prefecture, associated with abundant specimens of *Anadara ninohensis* OTUKA, *Chlamys kaneharai*, *Laevicardium shiobarense* (YOKOYAMA), *Dosinia kaneharai*, etc. They are all water worn or sometimes fragments, but are arranged parallel with the bedding plane and with the convex side upwards. However, in a higher horizon at the same locality, several intact valves of *paraplebejus* were collected from a medium-grained sandstone, associated with intact valves of *Anadara*, *Chlamys*, *Dosinia*, etc. These are arranged parallel with the bedding plane and with their left valve facing upwards and the right valve downwards, therefore, it is considered that they are buried *in situ* or not subject to much transportation if any. Their isolated valves are rather well preserved and are parallel with the bedding plane and with the convex side upwards.

A few intact valves of *paraplebejus* occur from the calcareous medium-grained sandstone of the Tanagura formation at Kamitoyo, Tanagura-machi, Higashi-Shirakawa-gun, Fukushima Prefecture, associated with *Miyagipecten matsumoriensis*, *Tanakura tanakura*, echinoid spines and balanid fragments. These are arranged parallel with the bedding plane and with natural orientation. Therefore, it can be inferred that *paraplebejus* at Kamitoyo was probably buried *in situ* or not subject to transportation from a remote place.

S. NOMURA and K. HATAI (1937) reported on the occurrence of *paraplebejus* from the pebbly conglomerate of the Nanakita formation at Matsumori, Izumi machi, Miyagi-gun, Miyagi Prefecture. Preliminary sedimentological studies of the Nanakita formation which yields abundant molluscan shells were undertaken by the writer (1957) and it was concluded that the pebbly conglomerate containing abundant *Glycymeris matsumoriensis* NOMURA and HATAI, *Chlamys kaneharai*, *Patinopecten matumoriensis* (NAKAMURA), etc. was subjected to strong water current moving from north to south.

The Ginzan formation developed in the vicinity of the Ginzan Hot Spring, Obanazawa-machi, Kita-Murayama-gun, Yamagata Prefecture, where abundant specimens of *paraplebejus* occur, consists of pebbly conglomerate to conglomeratic very coarse-grained sandstone, associated with abundant pelecypods, gastropods and brachiopods. A rather large number of *paraplebejus* consists of water worn and some with more or less broken shells, usually arranged parallel with the bedding plane. Some shells are arranged with their concave side upwards or in irregular position, but the majority are arranged parallel with the bedding plane and with their convex side upwards.

It has been known that the single valves which are arranged with convex side upwards represent the most stable position in the water and may serve to determine the top of the sedimentary rocks (F. TRUSHEIM, 1931, F. H. LEHES, 1941, R. R. SCHROCK, 1948, H. W. MENARD and A. J. BOUCOT, 1951, etc.). However, the numerous specimens which are arranged parallel with the bedding plane and with their convex side downwards as at Okada, Tanagura-machi, are in need of a different interpretation from that of the other localities. In such case it is considered that the smaller shells may

have been transported by suspension from their site of living to that of burial, while the larger ones were probably transported by traction or sliding. In other words, selective transportation was the most effective agency. It is thought that transported isolated valves sunk in the water bottom and settled with the convex side downwards and the concave side upwards, due to being dropped where the water current was lost its transporting power to become buried. This view is upheld by that when concavo-convex shells are thrown into still water, they settle with their convex side downwards. It is also considered that the shell concentration in a given layer depends upon the competency of the bottom current throughout the period of time represented by the deposits.

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Explanation of Plate 1

Figs. 1-6. *Patinopecten paraplebejus* (NOMURA and HATAI)

1. Right valve, ×4/5. DGS, Reg. No. 3360. Loc. Namesawa, Obanazawa-machi, Kita-Murayama-gun, Yamagata Prefecture. Ginzan formation.
2. Right valve, ×1. DGS, Reg. No. 3683. Loc. Okada, Tanagura-machi, Higashi-Shirakawa-gun, Fukushima Prefecture. Tanagura formation.
3. Right valve, ×1. DGS, Reg. No. 3614. Loc. Same as above.
4. Left valve, ×1. Paratype, SM. Reg. No. 2649. Loc. Same as above.
5. Left valve, ×1. DGS, Reg. No. 3615. Loc. Same as above.

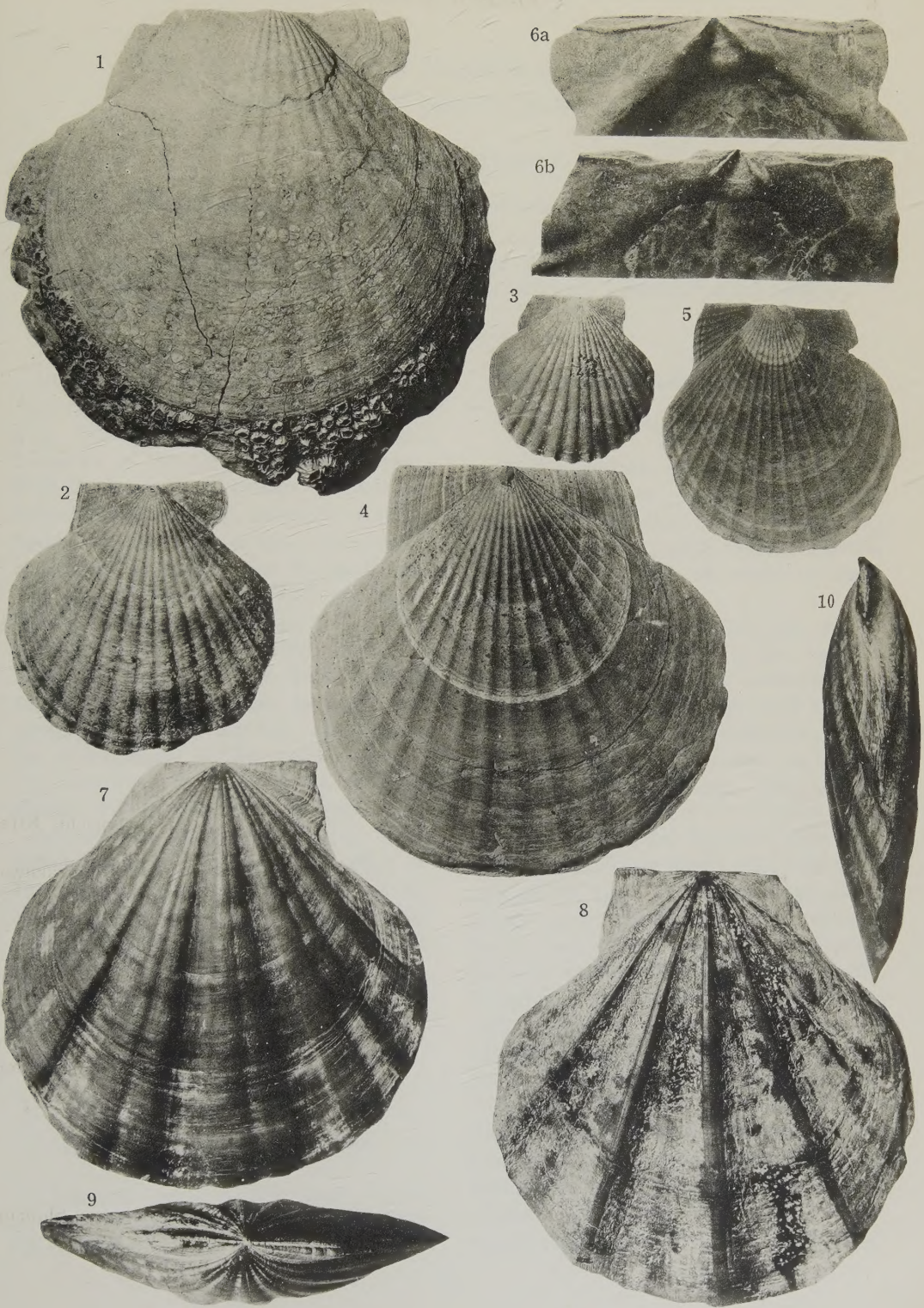
6a. Hinge area of right valve, ×1. DGS, Reg. No. 3617. Loc. Kamitoyo, Tanagura-machi, Higashi-Shirakawa-gun, Fukushima Prefecture. Tanagure formation.

6b. Hinge area of Left valve, ×1. DGS, Reg. No. 3617. Loc. Same as above.

Figs. 7-10. *Patinopecten imamurai* MASUDA, n. sp. Reg. No. TN, N. 1. Geological and Mineralogical Institute, Faculty of Science, Hiroshima University.

7. Right valve, ×1.
8. Left valve, ×1.
9. Upper view of the same, ×1.
10. Anterior profile of the same, ×1.

Loc. Railroad cutting of the San-in Line at Akazaki, Nima-machi, Nima-gun, Shimane Prefecture. Kawai formation.



MASUDA photo.

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 33, pp. 7-8, pl. 1, April 1, 1959

353. *PATINOPECTEN IMAMURAI* MASUDA, N. SP. FROM SHIMANE PREFECTURE, JAPAN*

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島根県産帆立貝の新種 *Patinopecten imamurai*: 広島大学今村外治教授が，島根県邇摩郡仁摩町赤崎，山陰本線鉄道切割りの川合層 (early Miocene) より採集した帆立貝の新種を記載し，*imamurai*と命名した。 増田孝一郎

During his geological studies in the vicinity of Akazaki, Nima-machi, Nima-gun, Shimane Prefecture, Prof. Sotoji IMAMURA of the Geological and Mineralogical Institute, Faculty of Science, Hiroshima University, collected an interesting scallop from a very fine-grained sandstone of the Miocene Kawai formation in association with other molluscan fossils. This fossil was turned over to the writer for examination, and as a result of study, it was found that it represents a new species to which the present article is devoted. Studies on the stratigraphy of this region are being continued by S. IMAMURA, and the details will be published by him.

Acknowledgements are due to Prof. Sotoji IMAMURA, for his kind offer of the specimen and for the information of the stratigraphy of Akazaki region of Shimane Prefecture, and to Dr. Kotora HATAI of the Department of Geology, Faculty of Education, Tohoku University, for reading the manuscript.

Family Pectinidae

Subfamily Pectininae

Genus *Patinopecten* DALL, 1898

Patinopecten imamurai MASUDA, n. sp.

Pl. 1, figs. 7-10.

Shell moderate, rather thin, compressed, orbicular in outline, equilateral except for auricles; right valve more convex than left; both valves radiately ribbed and forming an angle of about 100° at apex.

Right valve with eight, low, round-topped, smooth radial ribs and fine concentric growth lines, and ornamented by obtuse network; radial ribs much broader than their interspaces in central part of disc, and divided into two parts, one being somewhat larger than other; radial ribs at lateral extremities very low and slender, and narrower than their interspaces; bifurcated radial ribs ornamented by very weak, fine longitudinal striae only recognizable by reflected light near ventral margin; interspaces between radial ribs shallow and smooth; anterior auricle sculptured with several radial threads which tend to become obsolete towards margins and concentric lines, ornamented by fine network, and furnished with wide and shallow but distinct byssal notch and rather wide byssal area; posterior auricle similar to anterior in sculpture; hinge with rather distinct ctenolium. Left valve with seven, round-topped radial ribs orna-

* Received April 8, 1958; read at the annual meeting of the Society at Sendai, Feb. 2, 1957.

mented by fine longitudinal striae only recognizable by reflected light, intercalary threads and fine concentric growth lines, and ornamented by rather distinct network; radial ribs much narrower than their interspaces, rather sharp near beak, tend to become rounded towards ventral margin, divided into two or three radial threads by shallow longitudinal furrows near beak, but divided radial threads tend to become obsolete downwards; slender intercalary threads appear at beak and tend to become rounded towards ventral margin; auricles sculptured with several radial threads which tend to become obsolete towards margins and concentric lines, and ornamented by rather distinct network. Characters of hinge area and interior surface unknown.

Dimensions (in mm.): —Height 62.5, length 61.5, hinge-length ca. 26, thickness 16.5, apical angle 100°.

Comparison and Affinity:—This new species resembles *Patinopecten tokyoensis* (TOKUNAGA) (1906) from the Pleistocene deposits in the environs of Tokyo, but it can be distinguished therefrom by the smaller shell, the radial ribs which are divided into two parts by shallow longitudinal furrow, the smaller auricles, the ctenolium in the right valve and by the left valve having an intercalary thread between the radial ribs. Also it is distinguishable from *Patinopecten kobiyamai* KAMADA (1954) from the Jôban Coal-field and *Patinopecten chichibuensis* KANNO (1957) from the Chichibu basin, by the characters of the radial ribs of the right valve and an intercalary thread of the left valve.

Remarks:—This species is named in honor of Prof. Sotoji IMAMURA of the Hiroshima University.

The present new species is characterized by its more or less inflated right valve which is provided with eight, round-topped, smooth radial ribs which are broader than their interspaces in breadth and bifurcate at the beak, weak and fine radial threads on the backs of radial ribs, fine network on the surface, and rather distinct ctenolium. The left valve is characterized by having slightly inflated shell which is provided with narrower radial ribs which are divided into two or three parts by shallow longitudinal furrows near the beak but tend to become obsolete towards the ventral margin, an intercalary thread between the radial ribs, and rather distinct network on whole surface.

Depository:—Reg. No. TN. N, 1, Geological and Mineralogical Institute, Faculty of Science, Hiroshima University.

Locality, Geological formation and Age:—Railroad cutting of the San-in Line at Akazaki, Nima-machi, Nima-gun, Shimane Prefecture. Lat. 35°00′43″N., long. 132°24′04″E. Kawai formation. Early Miocene.

Associated fauna:—*Patinopecten kagamianus nimaensis* MASUDA, *Cyclina lunulata* MAKIYAMA, *Crenella fornicata* YOKOYAMA, *Lucinoma acutilineatum* (CONRAD), *Thracia hataii* KAMADA, *Mya cuneiformis* (BÖHN), *Calliostoma* n. sp.

Occurrence:—Known only from the type locality.

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Trans. Proc. Palaeont. Soc. Japan, N. S., No. 33, pp. 9-14, pl. 2, April 1, 1959

354. FOSSIL MOLLUSCAN FAUNA FROM THE ENVIRONS OF THE ZENKOJI HOT-SPRINGS, NAGANO PREFECTURE*

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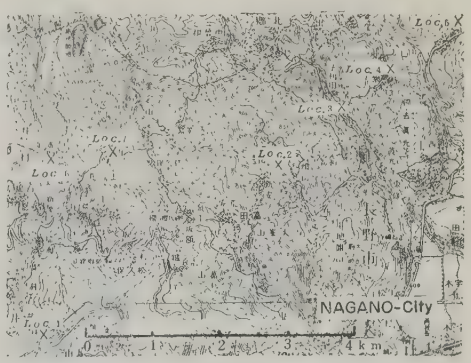
長野県善光寺温泉産貝化石群について：長野市西北方に分布する第三系を調査中，たまたま善光寺付近から産する貝化石群は，寒海型の貝化石群と暖海型の貝化石が混在している事実を発見したので，その意義を検討した。　菅野三郎・富沢恒雄

Introduction and Acknowledgements

One of the writers (Tomizawa) has been engaged in a geological survey for several years, of the area situated in the northwestern part of Nagano City, where the so-called Shigarami and Ogawa formations are well developed. This area has been studied by several authors as to its geology and paleontology, and of the workers the following should be mentioned, Makiyama (1927), Honma (1931), Kuroda (1931), Fujimoto and Kawada (1946), Saito (1956), and Tomizawa (see bibliography). However, there still remain problems concerning both stratigraphy and paleontology.

The Shigarami formation was first introduced by Honma (1931) for the andesitic tuff breccia, sandy mudstone, sandstone, conglomerate, and tuff developed in Shigarami-mura, Kami-minochi-gun, Nagano Prefecture, which is its type locality. This formation is conformably superposed upon the underlying Ogawa formation of Honma (1931), and unconformably succeeded by the Iizuna volcanic detritus. Although the geological age of the Ogawa formation is generally accepted as late Miocene, that of the Shigarami is considered to be early Pliocene by most previous authors.



Text-fig. Map showing the fossil localities

As a result of Tomizawa's geological studies a large collection of fossils have been made from the sediments outcropping near the Zenkoji Hot-springs in the eastern part of the type locality of the Shigarami formation. This large collection together with the newly accumu-

* Received April 23, 1958; read Feb. 9, 1957.

lated stratigraphical evidences are briefly treated in this paper.

Here the writers wish to express their gratitude to Profs. Haruyoshi FUJIMOTO and Wataru HASHIMOTO of the Geological and Mineralogical Institute, Faculty of Science, Tokyo University of Education, and Prof. Kotora HATAI of the Department of Geology, Faculty of Education, Tohoku University, for their valuable advice and encouragement.

Relation between the Lithofacies and Faunal Assemblages

TOMIZAWA subdivided the Shigarami formation developed in the area in question into five members as shown in Table 1.

Table 1. Stratigraphic sequence of the Shigarami and Ogawa formations developed in the northwestern part of Nagano City

	Iizuna volcanic detritus
	unconformity (part)
Shigarami formation	Kitago conglomerate member Ca. 500 m. thick.
	diastem (part)
	Daigakubo conglomeratic sandstone member. Ca. 400 m thick.
	Horita siltstone member. 400 m. thick.
Ogawa formation	Zenkoji siltstone member. 150–200 m. thick.
	Susobana tuff member. 700–800 m. thick.
	Asakawa mudstone member. Ca. 300 m. thick.

Brief descriptions of each of the member cited in Table 1, now follow, in ascending order.

1) Asakawa mudstone member. Dark gray mudstone with some foraminifers (*Haplophragmoides* sp., etc.). About 300 m. in maximum thickness.

2) Susobana tuff member. White or light yellowish liparitic tuff and tuff-breccia devoid of fossils. 700–800 m. in thickness.

3) Zenkoji siltstone member. Dark grayish siltstone or fine-grained sandstone. 150–200 m. in total thickness. This member has yielded, *Conchocele disjuncta* GABB (loc. 1), *Laevicardium angustum* (YOKOYAMA) (loc. 1), *Dosinia* (*Kaneharaia*) *kaneharai* YOKOYAMA (loc. 1), **Spisula sachalinensis* (SCHRENCK) (loc. 1), *Serripes makiyamai* (YOKOYAMA) (loc. 1), *Mya donaciformis* KURODA (loc. 1), *Buccinum shinanoense* MAKIYAMA (loc. 1), *Nassarius nakamurai* KURODA (loc. 1).

4) Horita siltstone member. Dark or dark grayish mudstone or grayish fine to medium-grained sandstone. 400 m. in thickness. This member has yielded, *Anadara amicula* (YOKOYAMA) (locs. 3, 4), *Glycymeris yamasakii* (YOKOYAMA) (loc. 3), *Patinopecten yamasakii* (YOKOYAMA) (locs. 4, 5), *P. tryblium* (YOKOYAMA) (loc. 3), *Conchocele disjuncta* GABB (locs. 2, 3, 4), *Mya japonica* JAY (loc. 4), *Spisula* cf. *sachalinensis* (SCHRENCK) (loc. 3), *Turritella saishuensis* YOKOYAMA (loc. 3), *Natica janthostoma* DESHAYES (loc. 3).

5) Daigakubo conglomeratic sandstone member. Medium-to coarse-grained sandstone, conglomeratic. About 400 m. in thickness. It has yielded, **Anadara amicula* (YOKOYAMA) (loc. 7), *Glycymeris* sp. (loc. 6), *Patinopecten yessoensis* (JAY) (loc. 7), *P. yamasakii* (YOKOYAMA) (loc. 7), *Dosinia* sp. (loc. 6), *Buccinum shinano-*

* abundant species

ense Makiyama (loc. 7).

6) Kitago conglomerate member. Pebble conglomerate with intercalated thin-bedded lignite layers, white acidic tuff layers and sandstone lenses. Leaves of *Metasequoia disticha* Miki have been found. This member is about 500 m. in thickness.

Mode of Occurrence of the Fossils

The majority of the pelecypods in the collection consist of intact valves which are excellently preserved and some even retain their original coloration. Specimens with intact valves are generally found in the siltstone or silty sandstone, while those with isolated valves occur from sandstone. From the fresh appearance of the specimens with intact valves and their excellent preservations it can be inferred that they were either buried *in situ* or subjected to only very slight transportation. As their occurrence, the specimens from the silty rocks are found sporadically, while those from the sandstones are generally found from the concretions and are thus generally well preserved even though they are represented by external moulds.

From the mode of occurrence and state of preservation of molluscan fossils as well as from the structures of the fossil-bearing rocks, it is judged that the fossils were buried in situ, and if transported, the distance must have been very near.

Characteristics of the Present Fauna

Although the majority of the fossils cited above have been reported from the present area, *Serripes makiyamai* (Yokoyama) and *Dosinia* (*Kaneharaia*) *kaneharai* Yokoyama are reported for the first time. The former species was first recorded by Yokoyama (1928, p. 360, pl. 69, fig. 3) from the Miocene Ushigakubi formation in the Higashiyama oil-field, Niigata Prefecture, and subsequently included into the synonymy of *S. notabilis* Sowerby, by Otuka (1935, p. 60, pl. 1, figs. 9–10). However, the former one can be distinguished from the latter by having a more lower shell with regard to length and a more quadrangular shell outline.

Although the surface sculpture of *Dosinia* (*Kaneharaia*) *kaneharai* from the present area is not well preserved, the strong concentric cords with narrower interspaces, broad pallial sinus which ascends obliquely to the middle part of the shell rather acutely and with narrow and bluntly pointed apex, serve to determine its specific position. From such feature it may easily be distinguished from other species of *Dosinia* from Japan (Kanno, 1955, p. 82).

Dosinia (*Kaneharaia*) *kaneharai* which was first reported by Yokoyama (1926, p. 133, pl. 17, figs. 1–5; pl. 18, fig. 2) from the Miocene Kanomatazawa formation in the Shiobara area, Tochigi Prefecture, has been subsequently recorded by many authors from other regions, all of which are Miocene in age. For example it has been reported from the Miocene formations as the Narusawa in Iwate Prefecture (Nomura, 1935), Sennan district of Miyagi Prefecture (Nomura and Onisi, 1940), Sugota of Akita Prefecture (Otuka, 1936), Yanagawa of Fukushima Prefecture (Nomura and Zinbo, 1936), Tanagura of the same Prefecture Nomura and Hatai, 1936), Itahana of Gunma Prefecture (Fujimoto and Kobayashi, 1938), the Meisen district of North Korea (Makiyama, 1936), besides elsewhere. The associated fauna of *Dosinia* (*Kaneharaia*) *kaneharai* in localities from which it has been recorded comprise genera and species which, in general, are those

characteristic of subtropical, warm temperate but not those of cold water types. This fact is particularly noticeable in the early Miocene deposits.

It is worthy of note that in the present area *Dosinia* (*Kaneharai*) *kaneharai* occurs in association with *Spisula sachalinensis* (SCHRENCK) and *Serripes makiyamai* (YOKOYAMA). *Spisula sachalinensis* which is the most common species in the present fauna, is distributed in the Recent seas from 36°N. lat. to 45° N. lat. (KURODA and HABE, 1952), and the genus *Serripes* is a typical cold water species, being known only from seas north of 36° N. lat. Therefore, it is evident that the warm water species *Dosinia* (*Kaneharaia*) *kaneharai* occurs in association with typical cold water genera, as just mentioned. Accordingly, it is to be judged that the present fauna may indicate a rather cool type, the southward invasion of northern waters, the cause delimitting the geological range and extinction of *Dosinia* (*Kaneharaia*) *kaneharai*, and therefore, that the geological age of such a fauna is younger than that containing a typical warm water fauna since it is superposed on it.

Dosinia (*Kaneharaia*) *kaneharai* is generally associated with such pelecypods as *Chlamys kaneharai* (YOKOYAMA) and *Laevicardium shiobaraense* (YOKOYAMA) in the Miocene deposits of Japan. None of these three species extend their range up into the Pliocene, and only the first mentioned is known to occur with cold water types of shells, its geological range being longer than that of the other two. From the thermal conditions indicated by the three mentioned species with their associated forms, and from the stratigraphical position of *Dosinia* (*Kaneharaia*) *kaneharai* occurring with cold water forms, it is evident that the difference in oceanographical conditions as reflected in the fauna, may mark the boundary between the early and late Miocene of Japan.

The mixed fauna of cold water and warm water types as recognized in the present area is also known from the Suenomatsuyama formation (HATAI, 1941) in Iwate Prefecture, the Tôgeshita formation (HASHIMOTO, 1950) in Hokkaido and from the Kitaura formation (KOTAKA, 1958) and its correlatives in Aomori, Akita, Yamagata, and Niigata Prefectures. All of these are considered to represent the late or Upper Miocene.

Should remarks be added as to where the boundary between the Miocene and Pliocene should be drawn, the writers are in the opinion that it may be placed in a position, faunistically where the mixed fauna is superposed by a uniform cold water fauna in Northern Honshu and Hokkaido, and by a more mild one in central and southwest Honshu.

The Tertiary rocks developed near the Zenkoji hot-springs is considered to belong to the upper part of the Ogawa formation of HONMA (1934). It is in this particular horizon that the mixed fauna already referred to occurs. In the Horita siltstone member conformably superposed upon the Ogawa formation, abundant *Spisula* occur but *Dosinia* (*Kaneharaia*) *kaneharai* longer persists and the fauna as known at present changes.

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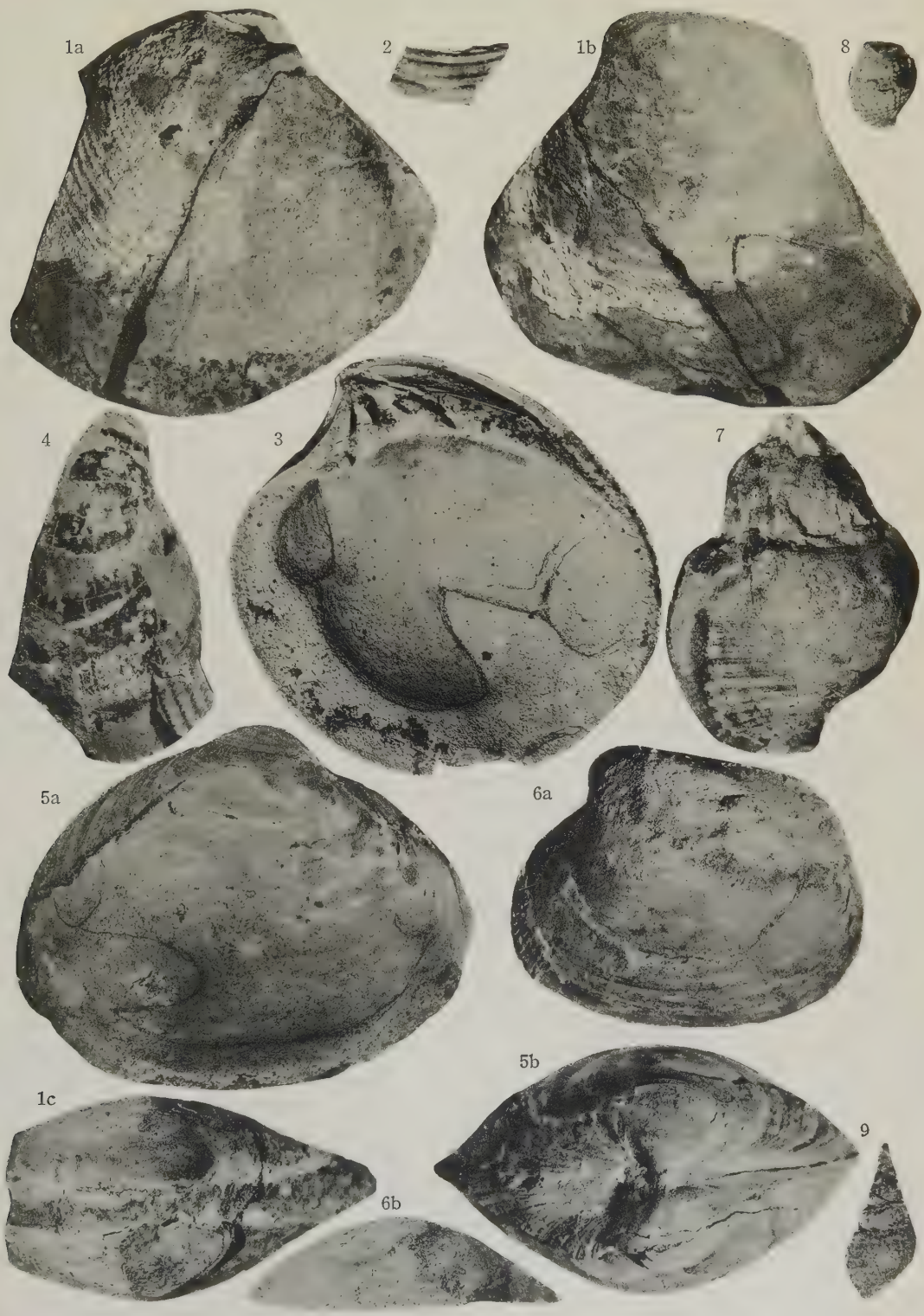
Explanation of Plate 2

(All figures in natural size)

Figs. 1a-c. *Dosinia* (*Kaneharaia*) *kaneharai* YOKOYAMA. Reg. No. 6203.
1a. Right valve, 1b. left valve, 1c. apical view of of 1a-b.
Fig. 2. The surface sculpture of *Dosinia* (*Kaneharaia*) *kaneharai* YOKOYAMA.
Fig. 3. *Dosinia* (*Kaneharaia*) *kaneharai* YOKOYAMA, Reg. No. 16704.
Collected from the Miocene Tanagura formation of Fukushima Prefecture, showing its pallial sinus for comparison.
Fig. 4. *Laevicardium angustum* (YOKOYAMA), Reg. No. 6204.
Figs. 5a-b. *Spisula sachalinensis* (SCHRENCK), Reg. No. 6205.
5a. Right valve, showing its pallial sinus, 5b. Apical view.
Figs. 6a-b. *Serripes makiyamai* (YOKOYAMA), Reg. No. 6206.
6a. Left valve, 6b. apical view.
Fig. 7. *Buccinum shinanoense* MAKIYAMA, Reg. No. 6207.
Figs. 8-9. *Nassarius nakamurai* KURODA, Reg. No. 6208.

Specimens figured in this plate are preserved in the Geological and Mineralogical Institute, Faculty of Science, Tokyo University of Education, Tokyo, Japan.



Aoki photo.

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 33, pp. 15-18, pl. 3, April 1, 1959

355. *PLICATOUNIO* OF THE WAKINO FORMATION

(Studies on the Molluscan fauna of the Cretaceous Inkstone series, Part 1)*

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脇野層産の *Plicatounio*：脇野亜層群の下部層，上部層のものを検討した結果 3 種（うち 1 種は新種）を識別した。これ等の分布は脇野層の分帯に役立つし，洛東統における分布ともよく対応する。又，系統発生について若干考察した。　太田喜久

Plicatounio is an important genus in the non-marine Wakino fauna of the Lower Cretaceous age. It was in 1936 that Kobayashi and Suzuki described *P. naktongensis* and *P. triangularis* from the Wakino series, but later Kobayashi (1956) excluded the latter from *Plicatounio* s. str.

I made a new collection from the lower and upper Wakino at various localities in which three species are distinguished as follows:

1. *Plicatounio naktongensis* Kobayashi and Suzuki .....rare
2. *P. naktongensis multiplicatus* Suzuki .....common
3. "*P.*" *kwanmonensis* Ota, n. sp. ..... rare

It is interesting to see that they serve not only for the zoning of the Wakino formation, but also for its precise correlation to the Naktong series.

Here I wish to record my sincere appreciations to Prof. T. Kobayashi of the University of Tokyo for his encouragement and criticism.

As pointed out by Kobayashi and Suzuki (1936), the hinge teeth and surface ornaments of *Plicatounio* serve for its distinction from *Unio*, *Nippononaia* and *Trigonioides*.

On the hinge-feature of *Plicatounio*

In the right valve of *P. naktongensis*, 5a running along the hinge margin is provided with a groove on the lower side and has fine lateral striation. 4a reveals very fine crenation on its crest as seen in recent *Unio* and *Corbicula*. 3a is distinctly crenated on its lower side but crenation happens to be more or less irregular, and its upper side shows only fine striation. Median tooth is somewhat obscure, rather massive and bears several oblique radial striae. 3b is a smooth slender tooth elongated and gradually narrowing toward the beak. 5b along the hinge margin is small and smooth. Fine crenation is sometimes seen on it near the beak.

"*P.*" *kwanmonensis* n. sp. is almost identical with the preceding in hinge nature, but has fine crenation on 3b near the beak.

P. naktongensis multiplicatus is very similar to the typical form in the hinge, but 3a is crenated only on the lower side in *naktongensis* and on both sides

* Received April 28, 1958; read June 6, 1958.

in *multiplicatus*. This means that distinct crenation exists on 4a in *multiplicatus*.

It is the tendency for the crenation of the hinge teeth to increase from *naktongensis* to *multiplicatus*. The crenation is never so regular in *Plicatounio* as in *Trigonioides*.

Difference between *Plicatounio* and *Nippononaia* or *Trigonioides*

(1) *Plicatounio* is similar to *Trigonioides* in the crenation of a certain tooth but there are many differences in the hinge.

(2) As *Nippononaia ryosekiana* was taken for a subgenus of *Plicatounio* by SUZUKI (1943), there are many similarities between them. Concerning the arrangement and crenation of the hinge teeth, *multiplicatus* and *kwanmonensis* are more similar to *ryosekiana* than *naktongensis*. There are, however, two differences between *Plicatounio* and *Nippononaia* as follows:

a) Crenation on pseudocardinal teeth is regular and extensive in *Nippononaia* whereas it is partial, irregular and oblique in *Plicatounio*.

b) The fine lateral striation is distinct on the teeth of *Plicatounio*, but they are rather obscure in *Nippononaia*. Namely, *Plicatounio* is similar to *Unio* in the presence of radial striae on the median tooth. *Nippononaia* has no striation on the tooth. *Plicatounio naktongensis* is similar to *Nippononaia ryosekiana* in the smooth postero-lateral teeth, but the former has distinct lateral striation. In *multiplicatus* crenations are found in the lateral teeth only in the vicinity of the beak.

Thus *Plicatounio* reveals better agreement with *Unio* than *Nippononaia*.

On the surface sculpture of *Plicatounio*

1. Posterior plication.
   P. naktongensis has two or three plications on the posterior side, two of which are distinct from the umbo.
   P. kwanmonensis is identical with *P. naktongensis* in the mode of plication.
   P. naktongensis multiplicatus has four or five plications, three or four of which are distinct in the whole length.
2. Radial ribs in front of the posterior plication.
   a) *Naktongensis* s. str. has no radial ribs, but the Wakino form has several weak ones. The ventral margin is crenated but gradually weakened forwardly.
   b) *Kwanmonensis* is identical with *naktongensis* in ribbing.
   c) In *multiplicatus* the shell is ribbed as far as the anterior margin, but the anterior ribs are weaker than the posterior ones. The ventral crenation is distinct even on the anterior margin.

Distribution of *Plicatounio*

Wakino subgroup	Lower	Middle	Upper	Uppermost
P. naktongensis	A	—	R	—
P. nak. multiplicatus	VR	—	A	—
P. kwanmonensis	VR	—	—	—

A: Abundant, R: Rare, VR: Very rare

As shown in the above table, *naktongensis* is abundant, and *multiplicatus* and *kwanmonensis* are very rare in the lower Wakino or Sengoku formation. In the upper Wakino or lower Wakamiya formation, on the contrary, *multiplicatus* is abundant, *naktongensis* rare and *kwan-*

monensis absent.

From these facts I am led to the conclusion as follows:

1. *Multiplicatus* was derived from *naktongensis*.
2. The number of the posterior plication increases and at the same time radial ribs become numerous.
3. The crenation of hinge teeth increases from *naktongensis* to *multiplicatus*.

If compared with the early Cretaceous species, the Senonian species have stronger and more numerous radial ribs as exemplified by *P. suzuki*, and more numerous fine ones as seen in *P. maxima*.

The correlation between the Wakino and Naktong series by *Plicatounio*

According to Suzuki, *P. naktongensis* is common in the Kinbu formation or lower Naktong series but rare in the Sinsyu formation or upper Naktong. *P. naktongensis multiplicatus* absent in the Kinbu is common in the Sinsyu formation.

Thus the occurrence of *Plicatounio* in the Wakino well agrees with that of the Naktong series. There are, however, some differences in that *kwanmonensis* and *multiplicatus* occur in the lower Wakino but none is known from the lower Naktong series.

In conclusion I agree with Kobayashi and Suzuki in the correlation of the Wakino to the Naktong series.

Description of Species

Genus *Plicatounio* Kobayashi and Suzuki

"Plicatounio" kwanmonensis Ota n. sp.

Pl. 3, Figs. 1-3.

Description:—Shell medium in size, subquadrate, inequilateral, relatively short for *Plicatounio* and round in front, prolonged and subtruncated in posterior and broadly arcuated on ventral side; beak large and located at a fourth of shell from anterior, fairly prominent but not high and distinctly prosogyrous. Posterior ridge broad and blunt; surface ornamented with two or three wide and moderately elevated plications radiating from umbo to posterior margin and more than ten radial ribs in front of these plications; hinge teeth well developed, in the right valve, 3a distinctly crenated on its lower side and much stronger than 5a which is narrow and smooth; median tooth indistinct, rather massive and obliquely and radially striated; 3b feebly crenated only near beak on its upper side and short but thicker than 5b which is narrow but elongated and finely crenated; anterior adductor scar subtrigonal and fairly large and stronger than posterior one.

Measurements:—The holotype specimen measures about 45 mm and 50 mm in height and length respectively. (Pl. 3 Fig. 1)

Comparison:—This species differs from *P. naktongensis* and *P. naktongensis multiplicatus* in the subquadrate outline. In the surface ornament it is identical with *P. naktongensis*. In the pseudocardinal teeth it is more similar to *Nippononaia* than *P. naktongensis* but the ornament is quite different from that of *Nippononaia*. Because the outline of the shell is so high, it may turn out a new genus or subgenus, if better material is available.

Formation and Locality:—Sengoku formation in the Wakino subgroup. The locality is at the northern 150 m part from the basal conglomerate along the Yakiyama river, east of Rikimaru.

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Explanation of Plate 3

All figures in natural size.

"Plicatounio" kwanmonensis Ota, new species. ..... p. 17

Fig. 1. Holotype; Right internal mould. (Wl. S. 5100)
Fig. 2. Paratype; Left internal mould showing hinge teeth. (Wl. S. 5005)
Fig. 3. Imperfect right internal mould. (Wl. S. 4403)

Plicatounio naktongensis Kobayashi and Suzuki

Fig. 4. Internal moud of a right valve. (Wl. S. 5004)
Fig. 5. A right valve. (Wl. S. 5033)
Fig. 6. Internal mould of an imperfect bivalved shell. (Wu. K. 115)
Fig. 7. Internal mould of imperfect left valve. (Wl. S. 5030)
Fig. 8. Internal mould of an imperfect left valve. (Wl. S. 5009)

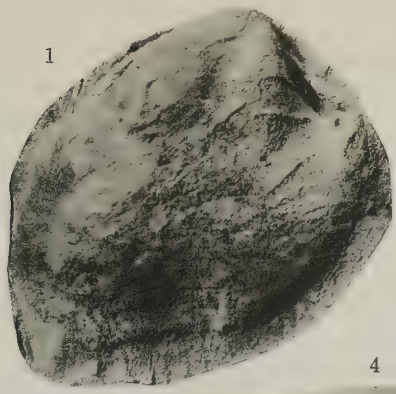
Plicatounio naktongensis multiplicatus Suzuki

Fig. 9. Internal mould of a deformed imperfect left valve. (Wl. S. 5060)
Fig. 10. External cast of a left valve. (Wu. K. 115)
Fig. 11. Internal mould of an imperfect right valve. (Wl. S. 5034)

Wl. S.:—Sengoku, Miyata-machi, Kurate-gun, Fukuoka Prefecture, in the Lower formation of the Wakino subgroup.

Wu. K.:—Katsuki-machi, Yahata City, Fukuoka Prefecture, in the Upper formation of the Wakino subgroup.

Repository:—All illustrated specimens are kept in the Fukuoka Liberal Arts College.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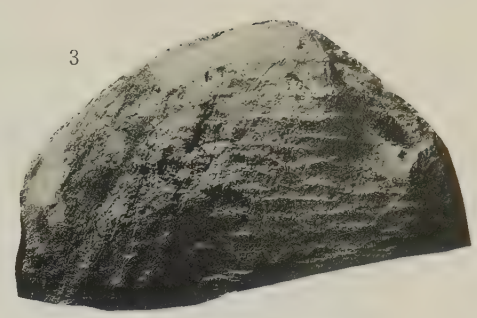
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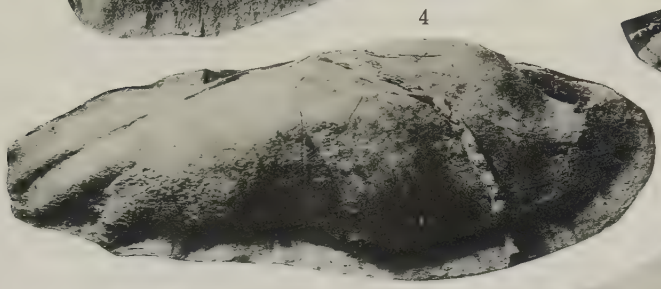
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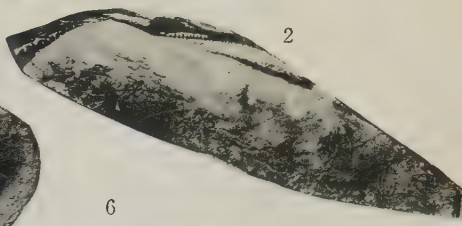
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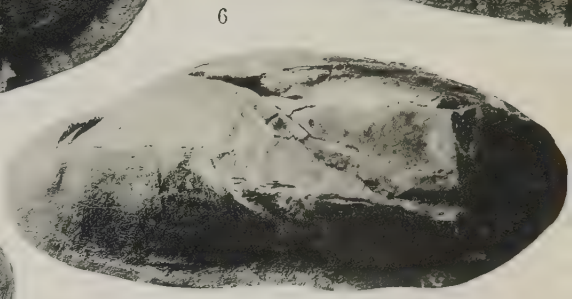
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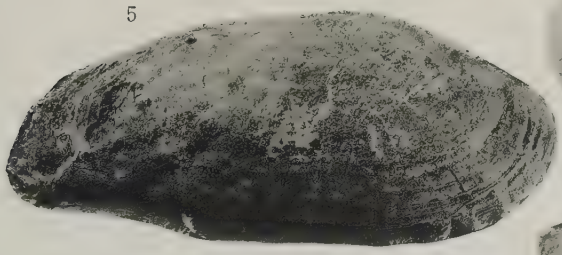
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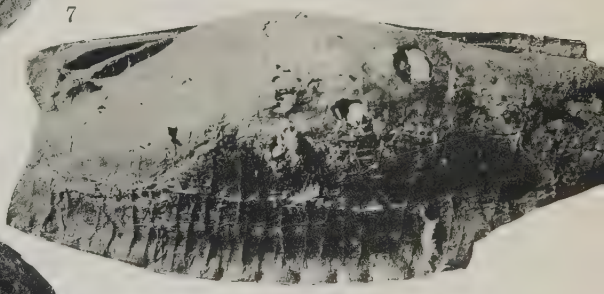
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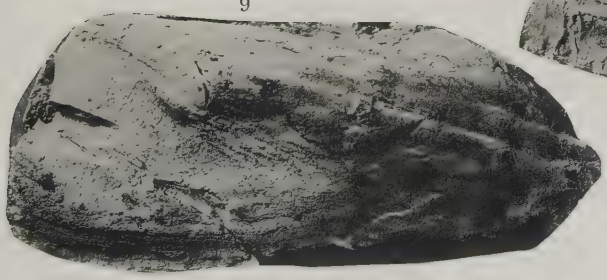
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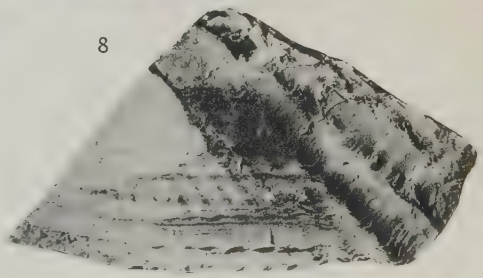
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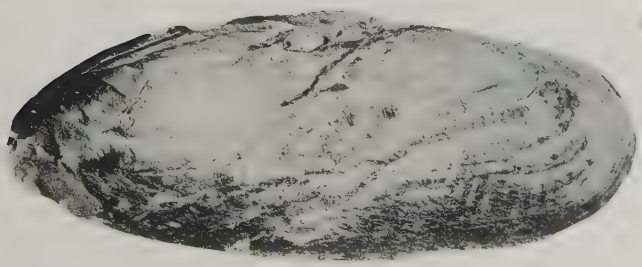
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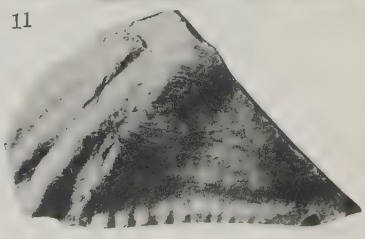
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Trans. Proc. Palaeont. Soc. Japan, N. S., No. 33, pp. 19-22, pl. 4, April 1, 1959

356. A PLEISTOCENE MARINE FAUNA FROM NEAR THE CITIES OF TSU AND YOKKAICHI, MIE PREFECTURE, SOUTHWEST JAPAN*

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三重県津市及び四日市市附近の更新統海棲動物群：三重県では志摩半島以外には海成更新統が知られていなかったが，今回津市及び四日市市附近で，*Ostrea* (*Crassostrea*) *gigas*, *Trapezium* (*Neotrapezium*) *liratum*, *Rotalia beccarii* 等を含む更新統が見つかったので報告した。

荒 木 慶 雄

Introduction and Acknowledgements

The occurrence of marine Pleistocene deposits in Mie Prefecture have been hitherto known only from the Shima Peninsula in its southeastern part (Iizuka, 1928; Otuka, 1928; Matsushita, 1932; Oinomikado, 1933; Makiyama and Nakagawa, 1941). Among these authors, Matsushita and Oinomikado listed the molluscan fossils from Kiba, Isobe-cho, Shima-gun, and Makiyama and Nakagawa reported on the smaller foraminifers from the same locality and horizon as treated by Matsushita and Oinomikado. With regard to the geology of the Pleistocene deposits, Iizuka, Otuka and Matsushita have published accounts.

However, marine Pleistocene deposits have not been known from areas other than that of the Shima Peninsula in Mie Prefecture. For such reasons it is thought that the present discovery of marine Pleistocene deposits from near the Cities of Tsu and Yokkaichi may be of importance with regard to the late Cenozoic history of Mie Prefecture. A brief account of the Pleistocene deposits newly discovered will be reported in this article and a full description will be reserved for another opportunity.

* Received June 11, 1958; read April 26, 1958.

Here the writer thanks Professor Kotora Hatai of the Faculty of Education, Tohoku University, for his kind guidance with regard to the present work. Thanks are also due to Professors Shôshirô Hanzawa and Kiyoshi Asano and Mr. Yôkichi Takayanagi of the Institute of Geology and Paleontology, Faculty of Science, Tohoku University, for their encouragement in many ways. Acknowledgements are also expressed to Mr. Hideo Akamine, teacher of the Kambe High School, Suzuka City, Mie Prefecture, for his cooperation in the field and kindly joining in discussion of problems concerning the Pleistocene deposits of Mie Prefecture, and to teachers of the Agata Primary School, Yokkaichi City, for calling the writer's attention to the occurrence of fossils, which later proved to belong to the Pleistocene.

The Pleistocene Deposits and Fauna

The Pleistocene deposits newly discovered are distributed in the environs of Mitachi in the western part of Yokkaichi City; Handa, Tsu City; and Konobe, Hisai-chô, Isshi-gun; all in Mie Prefecture. In all of these places, the Pleistocene deposits consist of massive, bluish soft silt containing fossils as shown in Table 1.

considered to represented ecologic variants by S. SOLEM (1928), who states that large specimens of *liratum* will reach 45 mm in length, but the average is nearer 25–30 mm. The specimens from the Pleistocene Mitachi and Konobe formations seem to be of average form.

Localities and Geological Formation:—Under the vegetable garden in the west of Mitachi Temple, Mitachi, western part of Yokkaichi City (Mitachi formation). Small cliff in the paddy-field along the Ai River in the northeastern part of Konobe, Hisai-chô, Isshi-gun (Konobe formation); under the Terrace deposits exposed near the road leading from Handa to Hisai-chô, middle part of Handa, Tsu City (Konobe formation); all in Mie Prefecture. Pleistocene.

Depository:—Mie University.

Geological Distribution:—Known from several areas of the Pleistocene deposits in the Kanto Region, Central Japan.

Genus *Cerithidea* SWAINSON, 1840

Cerithidea species indet.

Several ill-preserved specimens in the form of casts are in the collection. Although they evidently belong to the genus *Cerithidea*, their specific names can not be determined until better specimens are found.

Locality and Geological Formation:—Under the vegetable garden in the west of Mitachi Temple, Mitachi, Western part of Yokkaichi City (Mitachi formtion), Pleistocene.

Depository:—Mie University.

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Explanation of Plate 4

Figs. 1a, 1b. *Ostrea* (*Crassostrea*) *gigas* THUNBERG. Upper (1a) and lower (1b) valves of the same individual. Loc. Under the vegetable garden in the west of Mitachi Temple, Mitachi, western part of Yokkaichi City, Mie Prefecture. 2/5

Figs. 2a–2f. *Trapezium* (*Neotrapezium*) *liratum* (REEVE). Figures of three different individuals. Loc. Same as above. Natural size

Kumagai photo.

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 33, pp. 23-32, Pl. 5, April 1, 1959

357. TRIGONIIDAE, OSTREIDAE, BAKEVELLIIDAE, PTERIIDAE, CARDIIDAE AND ASTARTIDAE FROM THE UPPER JURASSIC SAKAMOTO FORMATION IN CENTRAL KYUSHU, JAPAN*

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上部ジュラ系坂本層の二枚貝化石：中部九州秩父帯に分布する上部ジュラ系坂本層産二枚貝化石のうち，Trigoniidae (5 種，うち 2 新種)，Ostreidae (2 種，うち 1 新種)，Bakevelliidae (1 種)，Pteriidae (1 種)，Cardiidae (1 種)，及び Astartidae (6 種，うち 3 新種) にぞくするものを記載した。このうち *Myophorella* (*Haidaia*) *pulex* TAMURA, new species は幼形より成体に至るいくつかの段階に亘って形態変化が観察される。田　村　　実

The Sakamoto formation containing the so-called Torinosu limestone is generally thought Upper Jurassic. Its black shale and limestone contain many animal fossils. Stratigraphic results at Sakamoto are summarized in Table 1 and fossil localities shown in Figs. 1a-c and Table 2. The horizon 5 in Table 1 is especially fossiliferous, yielding ammonites, pelecypods, gastropods and echinoids. Some fossils occur in the lower or upper horizons. *Aulacosphinctes* which is a guide fossil of Tithonian in Nepal, India, South Abyssinian plateau, Madagascar, Mexico and Argentina (ARKELL, 1956) was collected at Sakamoto (Loc. 4). (See Table 2 and Figs. 1b, c).

Here are described pelecypods belong-

Table 1. Stratigraphic Sequence of Sakamoto Formation

rock	horizon	fossils	thickness (m)
coarse ss. & alt. of ss. & sh. (ss>sh)	7	stromatoporoids & corals from ls. pebbles in congl. lens.	62
fine alt. of ss. & sh. (sh>ss)	6	no fossil.	28
sh	5	rich in pelecypods, gastropods, brachiopods, echinoids, *Aulacosphinctes* etc.	77
fine alt. of ss. & sh. (sh>ss)	4	no fossil.	42
ls bearing sh.	3	ls. rich in stromatoporoids, corals and echinoid spines. pectinids and other pelecypods from sh.	42
alt. of sh. & ss. (sh>ss)	2	one pelecypod's fragment only.	35
basal ss.	1	no fossil.	50

* Received Aug. 13, 1958; read Sept. 27, 1958.

Fig. 1a.

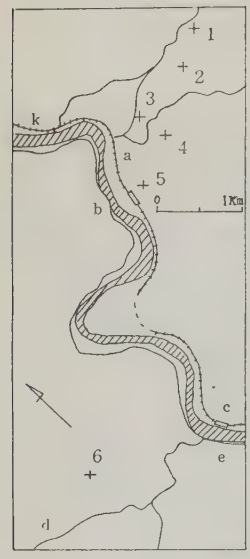

Fig. 1b.

Sakamoto area

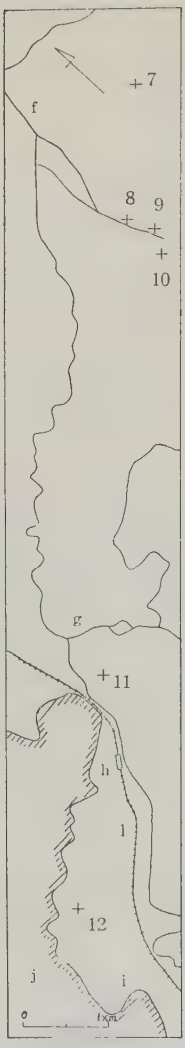

Fig. 1c.

Tanoura area

Fig. 1a: Situation of Sakamoto area
Figs. 1b, c: Fossil localities
1-12: See Table 2
F: Fukuoka city
K: Kumamoto city
N: Nagasaki city
S: Sakamoto
T: Tanoura
a: Sakamoto
b: Sakamoto station
c: Hagi station
d: Tsurubami
e: Kuma river
f: Futami
g: Tanoura
h: Tanoura station
i: Uminoura
j: Shiranuhi sea
k: Hisatsu-line
l: Kagoshima-line

Table 2. Fossil Localities (A) and Horizons (B)

A	B	Rock	Locality
1	5	fine ss	Eri, Shimomatsukuma-village, Yatsushiro-co.
2	5	sh	Kozaki, „
3	3	sh	Sakamoto, Kamimatsukuma-village, Yatsushiro-co.
4	5	sh	Sakamoto, „
5	5	sandy sh	Matsuzaki, „
6	5	fine ss	Tsurubami, Kutaragi-village, Ashikita-co.
7	5	sh	Futami, Yatsushiro-city.
8	3	ls	Ohira, „
9	5	sh	„ „
10	5	sh	„ „
11	5	sh	Tanoura, Tanoura-village, Ashikita-co.
12	5	sh	Uminoura, „

ing to Trigoniidae, Ostreidae, Bakevelliidae, Pteriidae, Cardiidae and Astartidae as follows:

Myophorella (*Haidaia*) *gracilenta* KOBAYASHI
Myophorella (*Haidaia*) *pulex* TAMURA, new species
Myophorella (*Haidaia*) *ohmachii* TAMURA, new species
Myophorella (*Promyophorella*) a sp. indet.
Myophorella (*Promyophorella ?*) b sp. indet.
Liostrea sp. indet.
Exogyra kumensis TAMURA, new species.
Gervillella ? sp.
Pteroperna sp.
Protocardia tosensis KIMURA
Astarte higoensis TAMURA, new species
Astarte ogawensis KIMURA
Astarte sakamotoensis TAMURA, new species
Astarte defecta TAMURA, new species
Astarte sp. indet.
Astarte ? sp. aff. *hermanni* OPPEL

The writer expresses his hearty thanks to Prof. T. KOBAYASHI of the University of Tokyo for his kind guid-

ance and supervision of the manuscript and to Messrs. I. Hayami and A. Tokuyama for their assistances in laboratory works.

Family **Trigoniidae** Lamarck

In the latter half of the Jurassic Period, the Myophorellinae took the place of the Vaugoniinae predominant in the Lower Jurassic in Japan. *Haidaia* and *Promyophorella* are subgenera of *Myophorella* which flourished in the late Jurassic Torinosu Sea (Kobayashi, 1956).

The crenulation on the disk is the distinction of *Haidaia* from other subgenera. It is fine in Soma forms (30–50 on a costa) but coarse in Sakamoto ones (10–30 on a costa). Coarse forms of *Haidaia* are difficult to distinguish from *Promyophorella* when the crenulation becomes coarse or turns out tubercles. *Myophorella* (*Promyophorella*?) b sp. is such an example.

The Sakamoto Trigonians are similar to those from the Torinosu group in Sakawa basin but the similarity is not so great as recognized in other genera of pelecypods (Kimura, 1951, 1956) from Sakamoto and Sakawa areas. Most specimens from the Sakamoto formation belong to *M.* (*H.*) *gracilenta* which has been reported from the Torinosu group at Sakawa basin, although *Linotrigonia toyamai* (Yehara 1923, Kimura 1956b, Kobayashi 1956) is more common in the basin.

Genus *Myophorella* Bayle, 1878

Subgenus *Haidaia* Crickmay, em. Kobayashi and Tamura, 1955

Myophorella (*Haidaia*) *gracilenta* Kobayashi

Pl. 5, Figs. 19–22.

1956. *Myophorella* (*Haidaia*) *gracilenta*, Kobayashi, p. 4, pl. 1, fig. 8.

The shell is small and costae are 10–12 in number generally, though some 15 costae are countable on the holotype. Because some Sakawa specimens also have 10–12 costae, the writer included the Sakamoto form in this species.

Occurrence:—Many good internal and external moulds of both valves from Locs. 1, 2, 4, 6, 7, 9, 11, 12.

Myophorella (*Haidaia*) *pulex* Tamura, new species

Pl. 5, Figs. 15–18.

Description:—Shell small for genus, a little convex, trigonal in outline; anterior margin a little produced; umbo submesial; surface divided into three parts by internal and marginal carinae; escutcheon narrow, depressed, finely costellate but about 5 upper coarse costellae each united with a costa on disk; marginal carina not stout and slightly tuberculate; disk ornamented with 8 or more crenulated costae.

Observation and Comparison:—Several external moulds of both valves show morphological changes through growth. In the first stage (Fig. 2–1, Tab. 3–1) surface is divided into areas, ante-carinal and remaining parts of disk, except for escutcheon. The ante-carinal part is non-crenulate and wide relative to the other parts. In the next stage (Fig. 2–2, Tab. 3–2), this part becomes narrower. In the third or the fourth stage (Fig. 2–3 and 2–4, Tab. 3–3 and 3–4) it becomes relatively narrow and looks like a part of disk. Costellae on area, in the first and second stages, are united to costae on disk through the ante-carinal part. In the fourth stage where disk has 6 or 7 costae, all costellae on area are not united to costae. From this stage, costellae

become numerous and finer. The relation is summarized in the Table 3 and Figure 2 briefly. The same relation seen in *gracilenta* and *ohmachii* is commonly met with in *Haidaia*.

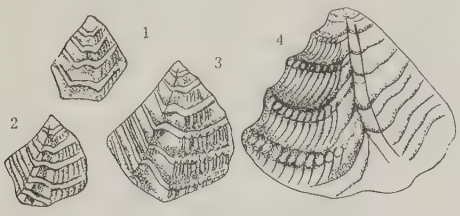

Fig. 2 and Tab. 3. Morphological changes of *Myophorella* (*Haidaia*) *pulex* TAMURA from young to adult stage.

stage (Fig. 2)	H (mm)	L (mm)	costae	costae united with costellae
1	2.5	3	3	4
2	3.5	4	4	5
3	5+	5+	7+	5
4	10+	9+	7+	5

This is closely allied to *M.* (*H.*) *gracilenta* in ornaments. But in the latter the shell is more slender and the crenulation on disk finer than the former (about 15 on a disk in *pulex* and about 30 or more in *gracilenta*).

Occurrence:—Locs. 4, 11, 12 and Mimikire, Sakawa basin, Shikoku.

Myophorella (*Haidaia*) *ohmachii*
TAMURA, new species

Pl. 5, Figs. 23–26.

Description:—Shell trigonally ovate, tall and fairly convex; umbo anterior; anterior and ventral margins a little rounded; posterior straight or a little arcuate; marginal carina weak; escutcheon carina indistinct; escutcheon narrow and smooth; area depressed, its median furrow indistinct, with coarse transverse 5–6 costellae in umbonal part and fine costellae in lower one; disk with some 9 costae roughly crenulated on ventral side upper five of which are confluent with costellae of area; costae a little tuberculose at intersection with crenulation.

Comparison:—This species represented by some broken casts and a bivalved specimen which is deformed and lacks a large part of disk. The crenulation on the disk is not densely disposed. At a glance this is very akin to *Myophorella* (*Promyophorella*?) *hashimotoi* KOBAYASHI (1956) from the Upper Jurassic Kurisaka formation in Awa, Shikoku, but the latter has a nodose sharp marginal carina and non-costellate area, though the costae near the umbo run into the area. In *M.* (*P.*?) *hashimotoi* only a few upper costae are crenulated.

Occurrence:—Locs. 11, 12.

Subgenus *Promyophorella* KOBAYASHI and TAMURA, 1955

Myophorella (*Promyophorella*)
a sp. indet.

Pl. 5, Fig. 27.

Only anterior half of disk (GK. G 8003) was collected by KANMERA and YAMASHITA of Kyushu Univ. The costae are about 14 in number as in *M.* (*P.*) *orientalis* KOBAYASHI and TAMURA (1955), though small tubercles on costae are invisible on this poorly preserved specimen. *M.* (*P.*?) *hashimotoi* is another species closely related to this but the costae are less numerous and more deeply sculptured in *hashimotoi* than in this.

Occurrence:—Loc. 1.

Myophorella (*Promyophorella*?)
b sp. indet.

Pl. 5, Fig. 28.

A broken external mould of left valve and its internal mould showing disk are in hand. A little tuberculate 8 or more costae are present on disk. Their interspaces are very wide. This species is probably new but specimens are very poor.

Occurrence:—Loc. 7.

Family **Ostreidae** Lamarck

Genus *Liostrea* H. Douvillé, 1904

Liostrea sp. indet.

Pl. 5, Fig. 32.

The sole broken external mould of left valve is probably referable to *Liostrea* s. str. by the lack of radial ribs and concentric lamellae and flat form.

Shell medium for genus, depressed, obliquely elongated; dorsal margin fairly long; ligament pit present; surface irregular.

Occurrence:—Loc. 1.

Genus *Exogyra* T. Say, 1820

Exogyra kumensis Tamura, new species

Pl. 5, Figs. 29-31.

Description:—Shell small for genus, suborbicular or subrectangular in outline, not so inflated for genus; attachment area in dorso-posterior part of left valve bounded by angulation, nearly as large as 1/3 of the shell surface; umbo twisted and opisthogyrous, although its coiling is intraceable; ligament pit triangular; surface covered with concentric lines. Internally a flat belt at mid-height of left valve, which has numerous fine radial striae, divides inner and outer concavity.

Comparison:—Represented by several small internal moulds and a poorly preserved external mould of left valve. The coiling of umbo is obscure on the internal mould. *Exogyra nana* (J. Sowerby) is widely distributed in England (Arkell, 1932), British Somaliland (Cox, 1935), Persia (Cox, 1936) and Cutch (Cox, 1952) from Bajocian to Portlandian and is very small-sized for the group. That species closely resembles this in general characters, especially in their small size, but in this species outline is less orbicular and a carina present on posterior side in that species is absent.

Occurrence:—Loc. 6.

Family **Bakevelliidae** King

Genus *Gervillella* L. Waagen, 1907

Gervillella ? sp.

Pl. 5, Fig. 38.

Description:—Shell very small, depressed, ensiform in outline; hinge-line straight except for a little projected umbo which is nearly terminal; anterior auricle very short, posterior one fairly long, narrow, obtuse-angled at the end; dorsal margin nearly straight; ventral a little rounded. In left valve, two cardinal teeth below umbo small, equal-sized; two laterals short, divergent, upper one of which is parallel to hinge and the other parallel to the margin between the auricle and body; a few obscure ligamental pits on hinge margin.

Comparison:—One imperfect internal mould, which is ensiform and lacks byssal gape, is probably referred to *Gervillella* Waagen. This is small and probably does not exceed 2 cm in length. A few weak ligament pits are aligned on the hinge margin. *Gervillella siliqua* (J. A. Eudes-Deslongchamps) from Upper Jurassic of Cutch (Cox, 1940) closely resembles this except for its anterior wing which is sharper and longer in the former.

Occurrence:—Loc. 4.

Family **Pteriidae** MEEK

Genus *Pteroperna* MORRIS and LYCETT, 1853

Pteroperna sp.

Pl. 5, Figs. 39, 40.

Description:—Shell small sized (length: 12 mm, height: 6 mm), inequilateral, moderately convex, pteriform in outline: both extremities winged; anterior wing short, acute-angled and a fourth as long as posterior one; umbo prosogyrate, a little projected beyond hinge-line, sulcated below posterior wing; body slightly inflated and expanded posteroventrally; ventral margin rounded. The details of the cardinal area unknown but a long, fairly deep groove is known to exist along hinge-line. Surface ornamented with concentric lines.

Comparison:—An internal and external mould of a left valve show *Pteroperna*, not only from their external aspects but also from a groove which runs along posterior hinge margin, although the characteristic parallel denticles can not be seen below the umbo. *Pteroperna* sp. from Divesian of Cutch by COX (1940) somewhat resembles this form, but the anterior wing of the former is long if compared to anterior one. *Pteroperna*? sp. by IMLAY (1945) from the Jurassic Cotton Valley formation in Louisiana closely resembles this form, but their detailed characters are unknown.

Occurrence:—Loc. 4.

Family **Cardiidae** LAMARCK

Genus *Protocardia* BEYRICH, 1845

Protocardia tosensis KIMURA

Pl. 5, Figs. 33–37.

1956b. *Protocardia tosensis*, KIMURA, p. 88, pl. 1, fig. 14.

Description:—Shell medium for genus, subequilateral, inflated, more or less trapeziform and longer than high; test thin; umbo inflated, nearly mesial, incurved, slightly prosogyrate and projected beyond hinge margin which is fairly long and straight; lateral margins nearly straight; posterior one oblique; ventral margin slightly rounded; carina distinct; anterior carina very obscure; both lateral side, especially posterior side, depressed; surface covered by regular and fine concentric lines, about 20 radial ribs in posterior side including also a little anterior part of carina; hinge characteristic of Cardiidae.

Comparison:—In the typical form from Sakawa basin the shell is more inflated and the situation of umbo lies a little posterior to center. KIMURA counted 9 radial ribs in posterior side of the internal mould. In the Sakamoto form radial ribs are also seen on the ventral side in the antecarinal part.

Two species of *Protocardia* by VOGEL (1896) from Upper ? Jurassic of Borneo resemble this species. *P. tenuicosta* has peculiar interspace's ornament of concentric lamellae; *P. multiformis* has 7–10 radial ribs on posterior side.

Occurrence:—Loc. 4.

Family **Astartidae** GRAY

Genus *Astarte* J. SOWERBY, 1816

Astarte higoensis TAMURA, new species

Pl. 5, Figs. 11–12.

Description:—Shell small to medium for genus, moderately depressed, slightly inequilateral, elongated and more or less rectangular in outline, longer than high; ventral margin nearly straight; anterior and posterior margins a little rounded;

umbo not prominent, forming about 120° apical angle, situated anterior or medial from the anterior end, prosogyrate; lunule indistinct; surface ornamented with very fine concentric ribs internal margin crenulate; one triangular cardinal tooth and a narrow anterior and posterior lateral tooth in right valve.

Measurements:—

	L	H
holotype	20 mm	15 mm
	15	12

Observation and Comparison:—Three specimens of internal and external moulds of right valves at hand are comparatively well preserved. Height's ratio to length is a little variable; umbonal position medial or a little posterior. The depressed and elongated-rectangular form, indistinct umbo and lunule are characteristics of this species. *Astarte kambarensis* Kimura is inflated and easily distinguishable from this species.

Occurrence:—Locs. 4, 6.

Astarte ogawensis Kimura

Pl. 5, Figs. 8-10.

1956b. *Astarte ogawensis* Kimura, p. 86, pl. 1, fig. 9.

Many external and internal moulds of both valves are at hand. This species is small in size and variable in convexity but fairly convex in general.

Occurrence:—This is one of the most common species in the Sakamoto formation, especially in the western half (Locs. 1, 6, 9, 11, 12.) of the area.

Astarte sakamotoensis Tamura, new species

Pl. 5, Figs. 1-3.

Description:—Shell small for genus, a little depressed, inequilateral, elongated subrectangular, much longer than high; umbo prosogyrate, not inflated, situated about 1/3 length from anterior end; anterior margin more or less terminated; postero-dorsal margin longer than anterior; both margins a little arcuated; posterior and ventral margins a little rounded; surface ornamented with 5–6 edged concentric ribs; internal margin crenulate.

Measurements:—

	L	H
holotype	12 mm	8 mm
	9	6
	9 ?	5 ?

Observation and Comparison:—This species is represented by a few internal and external moulds of right valves. The concentric ribs are characteristic of this species, *A. ogawensis* and *A. defecta*. These ribs are impressed internally but feeble in the umbonal part. In the internal mould (Pl. 5, Fig. 1), the lunule is deeply excavated.

This species is intimately related to *A. ogawensis* in concentric sculpture but its depressed and elongated form is easily distinguishable from the latter. *Astarte* (*Coelastarte*) cf. *A. rathieri* P. de Loriol (Pl. 40, Fig. 5, Imlay, 1945) resembles the specimen. But the number of ribs is 8–13 in the former.

Occurrence:—Locs. 4, 6, 9.

Astarte defecta Tamura, new species

Pl. 5, Figs. 4-7.

Description:—Shell small for genus, depressed strongly, subequilateral, orbicular in outline; height nearly equal to length; umbo prosogyrate, situated slightly anterior to median; apical angle

about 90°; postero-dorsal margin nearly straight or a little rounded; antero-dorsal margin a little excavated; ventral margin semi-circular; surface ornamented with about 5 concentric ribs on upper part; sculpture fading away in lower part where fine growth-lines are distinct; internal margin crenulate; strong trigonal tooth in left and two cardinals in right valve, one posterior lateral in right valve.

Measurements:—

holotype L: 9 mm H: 10 mm

Observation and Comparison:—This is represented by two internal moulds and an external mould. Nearly upper half of the surface is ornamented with the same elevated ribs as in *A. ogawensis* and *A. sakamotoensis*.

This closely resembles *A. ogawensis* except for its depressed form and surface ornaments. *A. wiltoni* MORRIS and LYCETT (1853) resembles this species but its concentric ribs are finer. *A. subsenecta* YABE and NAGAO from Sanchū-graben (1926) is alike to this species, but the former's concentric ribs are finer than the latter's and are limited to umbonal part.

Occurrence:—Locs. 1, 6, 12.

Astarte sp.

Pl. 5, Fig. 13.

Description:—Shell small, inequilateral, fairly convex, elongated-ovate in outline, longer than high; ventral margin rounded; umbo fairly inflated, prosogyrate, situated anterior to median; lunule small and shallow; surface with fine numerous concentric ribs; internal margin crenulate; hinge typical of the genus.

Measurements:—

L: 13 mm H: 10 mm

Comparison:—This is represented only by an internal mould of a left valve but fragmentary shells are attached on the ventral side of the specimen.

Astarte higoensis is similar to this in shape but the latter is more inflated and has a more inflated umbo than the latter. The inflated umbo and elongated shape of this easily distinguish this from *A. kambarensis* KIMURA in the Torinosu group in the Sakawa basin.

Occurrence:—Loc. 6.

Astarte? sp. aff. *hermanni* OPPEL

Pl. 5, Fig. 14.

One external mould of the left valve (length: 31 mm, height: 25 mm) in fine sandstone at Tsurubami may be allied to *Astarte hermanni* OPPEL from the Spiti Shale (HOLDHAUS, 1913), because of its external resemblances.

Shell medium for genus, moderately inflated, inequilateral, ovate and longer than high; umbo situated 1/5–1/6 length from anterior end, prosogyrate; posterior and ventral margins rounded; anterior margin short and arcuate; lunule distinct and deep; surface ornamented with numerous concentric striae.

This is relatively large, though most Astartidae from the Sakamoto formation are small. Compared to the Sakamoto form, the lunule is smaller and escutcheon more distinct in the Spiti form.

Occurrence:—Loc. 6.

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Explanation of Plate 5

Astarte sakamotoensis Tamura, new species

Fig. 1. Internal mould of a right valve; side view; Loc. 2. ×2.5. (MM 2977).

Figs. 2, 3. Plaster cast of the external mould and the internal mould of the holotype right valve; side view; Loc. 9. ×2.5. (MM 2976).

Astarte defecta Tamura, new species

Fig. 4. Clay cast of the external mould of the holotype right valve; side view; Loc. 12. ×2.5. (MM 2978).

Figs. 5, 6. Clay casts of the external and internal moulds of a left valve; side view; Loc. 1. ×2.5. (MM 2979).

Fig. 7. Clay cast of the external mould of a left valve; side view; Loc. 6. ×2. (MM 2980).

Astarte ogawensis Kimura

Fig. 8. Clay cast of the external mould of a left valve; side view; Loc. 12. ×2.5. (MM 2981).

Fig. 9. Plaster cast of the external mould of a left valve; side view; Loc. 12. ×2.5. (MM 2982).

Fig. 10. Internal mould of a right valve; side view; Loc. 12. ×2.5. (MM 2983).

Astarte higoensis Tamura, new species

Figs. 11, 12. Plaster cast of the external mould and internal mould of the holotype left valve; side view; Loc. 6. ×1. (MM 2986).

Astarte sp.

Fig. 13. Internal mould of a left valve; side view; Loc. 6. ×1. (MM 2986).

Astarte ? sp. aff. *hermanni* OPPEL

Fig. 14. Plaster cast of the external mould of a left valve; side view; Loc. 6. ×1. (MM 2987).

Myophorella (*Haidaia*) *pulex* TAMURA, new species

Fig. 15. Modeling cast of the external mould of the holotype left valve; side view; Loc. 4. ×5. (MM 2988).

Figs. 16–18. Modeling casts of external moulds of right valves; side view; Loc. 4. ×5. (MM 2989, 2990, 2991).

Myophorella (*Haidaia*) *gracilenta* KOBAYASHI

Fig. 19. Modeling cast of the external mould of a left valve; side view; Loc. 6. ×5. (MM 2993).

Fig. 20. Modeling cast of the external mould of a right valve; side view; Loc. 6. ×5. (MM 2994).

Fig. 21. Clay cast of the external mould of a left valve; side view; Loc. 6. ×2. (MM 2995).

Fig. 22. Internal mould of a right valve; side view; Loc. 6. ×5. (MM 2996).

Myophorella (*Haidaia*) *ohmachii* TAMURA, new species

Fig. 23. Internal mould of a left valve; side view; Loc. 11. ×2. (MM 2997).

Figs. 24, 25. Internal mould and a posterior part of the external mould of the holotype shell; anterior view (Fig. 24) and areal view (Fig. 25); Loc. 12. ×2. (MM 2998).

Fig. 26. Modeling cast of the external mould of a left valve; side view; Loc. 11. ×2. (MM 2999).

Myophorella (*Promyophorella*) a sp.

Fig. 27. Modeling cast of the broken external mould of a right valve; showing anterior half of disk; Loc. 1. ×1. (GK. G. 3003)

Myophorella (*Promyophorella?*) b sp.

Fig. 28. Modeling cast of the external mould of a right valve; side view; Loc. 7. ×2. (MM 3002).

Exogyra kumensis TAMURA, new species

Figs. 29–31. Internal moulds of left valves (holotype: Fig. 29); side view; Loc. 6. ×2. (MM 3003, 3004, 3005).

Liostrea sp.

Fig. 32. Clay cast of the broken external mould of a left valve; showing anterior part, Loc. 1. ×1. (MM 3006).

Protocardia tosensis KIMURA

Fig. 33. Internal mould of a right valve; side view showing hinge part; Loc. 4. ×1. (MM 3007).

Figs. 34, 35. Clay casts of the external and internal moulds of a left valve; showing posterior part (Fig. 35) and side view (Fig. 34); Loc. 4. ×1. (MM 3008).

Fig. 36. Internal mould of a right valve; side view; Loc. 4. ×1. (MM 3009).

Fig. 37. Internal mould of a left valve; side view; Loc. 4. ×1. (MM 3010).

Gervillella ? sp.

Fig. 38. Internal mould of a right valve; side view; Loc. 4. ×2. (MM 3011).

Pteroperna sp.

Figs. 39, 40. Internal mould and clay cast of external mould of a left valve; side view; Loc. 4. ×2. (MM 3012).

Photographed by UEKI (Figs. 19, 20, 22, 27, 28), KANMERA (Figs. 15–18) and the writer (others). All specimens here described except for Fig. 27 are kept in Geological Institute, University of Tokyo.


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358. ON SOME CARBONIFEROUS CORALS FROM THE KITAKAMI MOUNTAINS*

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北上山地産石炭紀珊瑚のあるものについて：南部北上山地産の以下の石炭紀珊瑚4種を記載した。

1) *Tschussovskenia? takedai*, n. sp. 岩手県気仙郡住田町鷹ノ巣沢中流の鬼丸統より武田裕幸氏採集にかゝるもので，新種と考えられる。なお，STUCKENBERG 氏の設けた "*Fischerina*" 属についての若干の考察を行った。
2) *Dibunophyllum bipartitum koninckl* (EDWARDS & HAIME) 岩手県大船渡市日頃市町長岩の長岩統より垣見俊弘氏採集のもの。
3) *Dibunophyllum* cf. *asiaticum* MINATO 同じく同町鬼丸の鬼丸統より垣見俊弘氏によって採集されたもので，かって *Clisaxophyllum* sp. として表示されたことのあるものである。
4) *Amygdalophyllum* sp. *a* 同町大森の日頃市統より橋本徹氏によって採集されたもので，湊が *A.* sp. *a* と呼んだものに同定される。この種の産出層準はこれまで不詳であったが，橋本氏によって日頃市統であることがわかり，かつ又，この種は *Amygdalophyllum* 属の中でも最も古期のものと考えられる。

記載を終えるに当って，標本を筆者の研究に委ねられた上記三氏の御厚意に対し，又日頃御指導を賜っている湊正雄教授に対し厚く御礼申し上げる。　　加　藤　　誠

In the present paper, the writer proposes to describe four Carboniferous rugose corals which have been collected from the southern Kitakami mountains, north-east Japan by gentlemen who were formerly undergraduate students of Hokkaido University.

Of the four the first one may be a new species possibly belonging to the genus *Tschussovskenia* DOBROLYUBOVA. This form was found unexpectedly in the collection of Mr. H. TAKEDA, who brought back the specimen from an outcrop of Onimaru limestone at Takanosu. This one is now called *Tschussovskenia? takedai*.

The second form is a species belonging to the genus *Dibunophyllum* and seems to be comparable with *Dibunophyllum bipartitum koninckl*, a well known British Carboniferous species. This form was once collected from the Middle Carboniferous Nagaiwa series by Mr. T. KAKIMI, at present a member of the Geological Survey of Japan.

The third one must be referable to *Dibunophyllum asiaticum* MINATO, although this may be the same specimen once listed by MINATO and others as *Clisaxophyllum* sp. in the former paper (1953). According to MINATO, this specimen also belongs to the collection of Mr. T. KAKIMI from the Onimaru series at its type locality.

The fourth coral is certainly assignable to genus *Amygdalophyllum*, but specifically indeterminable at the present moment owing to the ill preservation of the material. The specimens treated by the writer in this paper belong to the collection of Mr. T. HASHIMOTO. According to HASHIMOTO, these were

* Received July 29, 1958; read Sept. 27, 1958.

collected by him from the same locality as that from which MINATO once described the same species. The exact horizon of this coral is not certain, but may be the lowest part of the Etroeungtian Hikoroichi series.

The three species except for the last form should be regarded to have many similarities with those species in Europe. At least such types of rugose corals as *Tschussovskenia* ? *takedai* and *Dibunophyllum bipartitum konincki* have not been recorded from Asia yet.

Before going into description, the writer wishes to express his hearty thanks to those gentlemen who kindly offered their materials for the writer's study. He is also very much indebted to Professor MINATO of Hokkaido University for reading the paper in manuscript.

Description

Note on '*Fischerina*' STUCKENBERG, 1904

The genus *Fischerina* was proposed by STUCKENBERG in 1904, *Fischerina rossica* STUCKENBERG as the genotype which was brought from the Lower Carboniferous of Wychnij-Wolotschek in Central Russia.

Diagnosis made by STUCKENBERG follows;—

'Die zusammengesetzen Polypenstöcke dieser Gattung bestehen aus wenigen Zellen. Mir hat ein solcher vorgelegen, der nur aus zwei mit den Wände zusammengewachsenen Zellen von unregelmässig prismatischer Form zusammengesetzt war. Die Stern leisten zerfallen in zwei Ordnungen. Innerhalb der Zelle lassen sich drei Zonen unterscheiden. Die peripherische ist von Endothecalgewewe eingenommen, die mittlere von Böden, die auch in die Centralzone übergreifen. In der letzeren erblickt man ausser diesen sind und sich nicht im Centrum der Zelle schneiden. Die kräftiger entwickelten Septa reichen bis zur Centralzone, die schwächern aber über schreiten die Grenzen der peripherischen Zone nicht.,

STUCKENBERG's diagnosis seems to be somewhat insufficient to distinguish definitely his genus from the allied genera, and the writer is now going to offer a brief discussion on '*Fischerina*.'

Following STUCKENBERG, PERNA (1923) described a coral from the upper Lower Carboniferous of eastern slope of south Ural, and she assigned it to *Fischerina rossica* with some doubt. But she did not give any illustration for her specimens. The writer now holds a view that on the basis of her description, her specimens would be better considered to be a small variety of STUCKENBERG's species.

REED (1929) also assigned some fasciculate corals found in Carboniferous in Yunnan into *Fischerina*?, although he treated *Fischerina* as the subgenus of *Cyathophyllum*.

Cyathophyllum (*Fischerina*?)
insolitum REED
Cyathophyllum (*Fischerina*?)
solitarium REED

According to REED, his two forms possess long minor septa besides major septa of these two species are so long that they unite with each other at the center of corallite and this structure apparently represents a type of some axial structure but this does not represent a true columella. So, those two forms must be excluded from *Fischerina* STUCKENBERG.

GORSKY (1935) described *Lophophyllum vacuum* from the upper Viséan or slightly higher horizon than that developing in Novaya Zemlya. This species seems to the present writer to have some similarity with the genotype of '*Fischerina*'. As GORSKY already stated, it is not certain whether his species may be fas-

ciculate or solitary. But at any rate, the structure of the corallite is quite like to species of *Fischerina*.

Dobrolyubova (1936) accepted Stuckenberg's genus *Fischerina*, and described one coral under the name of *Fischerina stuckenbergi* from the Middle Carboniferous of the North Ural region.

Lang, Smith and Thomas (1940) stated that the generic name of *Fischerina* was preoccupied by a foraminiferal genus *Fischerina* Terquem, 1878, further they considered '*Fischerina*' Stuckenberg to be synonymous with genus *Lithostrotion* (sensu lato).

After having carefully reviewed the validity of the genus '*Fischerina*', Hill (1938, 1948) concluded that the so-called *Fischerina* may be synonymous with genus *Corwenia* Smith and Ryder. Very recently, however, she (1956) has revised her former view and stated belief in the possible synonymy between '*Fischerina*' and *Lithostrotion* (sensu lato) as Lang, Smith and Thomas once held.

But the writer can hardly follow the former view which was held by them.

'*Fischerina*' should be a fasciculate coral with herringbone dissepiments and weak axial structure. This is quite certain according to the original diagnosis and illustration given by Stuckenberg. Hence, '*Fischerina*' must be definitely distinguishable from *Lithostrotion* (sensu lato) which possesses concentric dissepiments in cross section and has typically a styliform columella.

In concern to the clisiophylloid nature of dissepiments arrnaged in herringbone pattern taken in conjunction with the fasciculate nature of corallum, '*Fischerina*' reminds one of genus *Corwenia*. But in *Corwenia*, the axial structure is rather regularly constructed in cobweb shape, and it is stout even in such primitive form as *Corwenia vaga* Smith and Ryder. On the contrary, in '*Fischerina*' the axial structure is weak, irregular and sometimes vertically discontinuous. In view of such consideration the writer does not consider '*Fischerina*' to be synonymous with true *Corwenia*.

Further genus *Koninckophyllum* Thomson & Nicholson seems to show resemblance to '*Fischerina*', but '*Fischerina*' provides no distinct fossulae and its dissepimentarium is not so widely developed as in *Koninckophyllum*. In *Koninckophyllum*, minor septa are usually well developed and columella is rather simply constructed, while minor septa usually degenerate and the columella is irregularly constructed in '*Fischerina*'. So, '*Fischerina*' is also distinguishable from *Koninckophyllum*.

Neokoninckophyllum Fomichev seems to have been not well accepted among palaeontologists; it is rather resemblant to *Koninckophyllum*. Anyhow *Neokoninckophyllum* is closely like '*Fischerina*' in respect to the nature of weak columella and dissepiments, but the former is considered to be solitary.

Genus *Stylastraea* Lonsdale seems to be another ally to the genus '*Fischerina*' the former of which has minor septa ill developed, and inosculating dissepiments. The dissepimentarium is very narrow, columella is weak, sometimes vertically discontinuous. So, *Stylastraea* may be quite similar to '*Fischerina*' in the fundamental construction of the corallites excepting for the cerioid nature of the former genus.

On the other hand, *Tschussovskenia* Dobrolyubova shows much more similarity to '*Fischerina*' Stuckenberg than any other allied genera. *Tschussovskenia* is represented by some corals in which each corallite does not show any constant characters either in the nature of columella or in dissepiments; one has

herringboné dissepiments in parts and another has rather concentric dissepiments; besides some other type partially lacks dissepiments even though they may reach the adult stage. The columella is also very variable in construction, and further, all the skeletal elements are rather thickly constructed at least in most corallites of this species.

Since the generic name '*Fischerina* STUCKENBERG' was already abondoned for the reason of homonymy, it cannot longer be employed. And if the genus '*Fischerina*' might be considered to be valid, a new generic name should be applied to it.

DOBROLYUBOVA once accepted '*Fischerina*,' but she also stated that there is a morphological gradation from '*Fischerina*' *stuckenbergi* to *Tschussovskenia capitosa* through *Tschussovskenia vesiculosa*. Both genera are so variable in their internal characters that they are differentiated with difficulty in detail, although forms of '*Fischerina*' have large corallites and comparatively regular, and more complicated internal characters than those in forms of *Tschussovskenia*.

So here the writer wishes to treat forms of '*Fischerina*' STUCKENBERG under the genus *Tschussovskenia*, postponing the final settlement of the validity of '*Fischerina*', instead of using the trivial name of '*Fischerina*'.

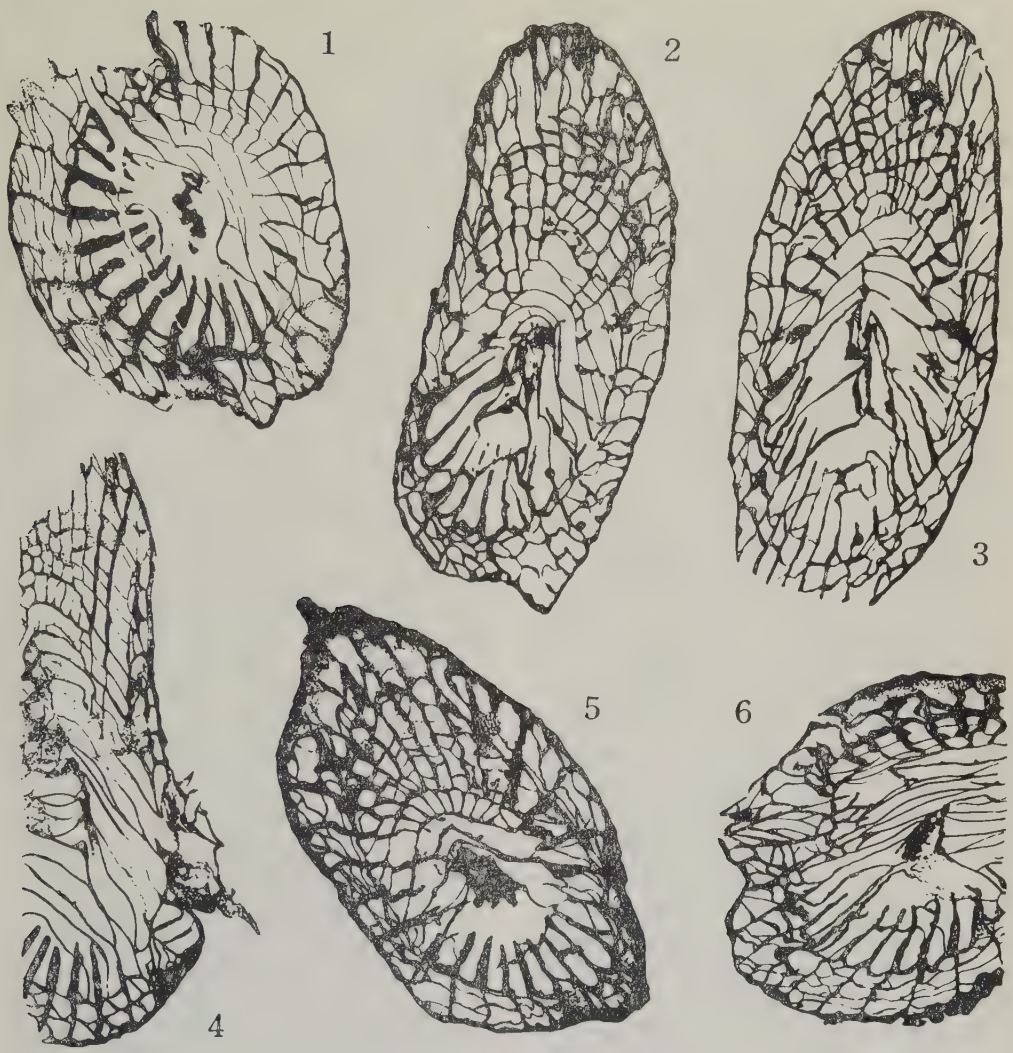
Tschussovskenia ? *takedai* sp. nov.

Text-figs. 1-6.

Corallum compound, fasciculate (inferred). Corallite cylindrical, straight or curved, weakly and irregularly aggregated, so both transverse and longitudinal sections of the corallites are often seen in one thin section. Corallites apart from each other as far as their diameters, but sometimes in contact. Corallites may be round in correctly cut transverse section, attaining about 0.8 to 1.5 cm in diameter, and clearly differentiated internally into three parts, namely dissepimental, tabulate and axial. Epitheca moderately thick. Septa short and in one order. Minor septa almost lacking, but may be present although they are very rare and very rudimentary. Major septa straight, fall short of the center of corallite, attain about one-third of the radius of corallite. Then, a considerable space is found around the axial structure in cross section. The numbers of septa and the diameters of different corallites are the following:—

27 major septa	in 12.5 mm
25 or 26	10.5
32	11.0
27	15.0

Major septa often dilate in tabularium, and when dilation may occur, the inner margin of the dissepimentarium makes a stereotheca. Dissepimentarium rather narrow, where two or sometimes many more rows of dissepiments are arranged in herringbone pattern in cross section. Axial structure rather simple and persistent. Median plate is discernible in some corallites but distinct septal lamellae and axial tabellae are not differentiated in any case. Sometimes, axial structure seems to be massive, taking irregular shape in cross section. In oblique section, dissepiments rather irregular in shape and in two or more rows, their convex sides being faced upwards and inwards. Tabulae usually flat domed in shape and complete; their outer margins bent downwards and in contact with the dissepimentarium. In the middle, tabulae gently arise to the axial structure. But, in one tangential section, steeply elevated conical tabulae are seen. Tabulae rather distantly disposed judg-



Text-figs. 1-6: *Tschussovskenia ? takedai*, sp. nov.
1. cross section; 2. oblique section;
3. oblique section; 4. oblique section;
5. oblique section; 6. oblique section.
(all figures three times natural size.)

ing from the oblique sections. Axial structure is platy and persistent.

Remarks:—So far as the writer is aware, in thin sections there is no indication of the possession of any connecting process or new bud in corallites of the present specimens. Most corallites are apart from each other but sometimes irregularly aggregated. The feature reminds one of some forms formerly described by Dobrolyubova (1936) and Gorsky (1935) under the names '*Fischerina*'

stuckenbergi and '*Lophophyllum*' *vacuum*. So, a slight doubt is still left in respect to the form of corallum of the present Japanese specimens. The writer is not sure whether the species now in concern should be considered as a fasciculate form or originally simple forms which are accidentally aggregated. If many simple corallites are found in aggregation in a small piece of rock, sometimes they may be misunderstood as to be fasciculate. If the latter is the case, the present form can not be considered synonymous with any other species ever known.

The characteristic features of the present form are as follows:—

1. minor septa nearly lacking
2. rather constant simple axial structure
3. intrathecal dilation of major septa
4. typical herringbone dissepiments

'*Lophophyllum*' *vacuum* GORSKY resembles the present one, but differs from the latter in having larger corallites, less numerous septa and more complicated axial structure than are to be found in the present Japanese form.

'*Fischerina*' *stuckenbergi* DOBROLYUBOVA is most nearly allied to the present form. According to DOBROLYUBOVA however, her species is quite variable in skeletal elements. She illustrated two types of corallites in her paper, which types are so different from each other that one may be apt to consider them not to be conspecific as she admitted. One type has a small corallite in which minor septa well develop; no dilation is observable in tabularium. Tabulae rather complete; dissepiments are few, and columella is irregularly and weakly constructed.

While the opposite is the condition in other individuals which have corallite much larger with minor septa rudimentary; tabulae are incomplete. Besides in this individual dilation is perceived in tabularium, dissepimentarium is comparatively thick and the columelle is continuous, rather persistent and rather regularly constructed.

Generally speaking the Japanese form now under discussion seems to have an intermediate nature between those two forms described and illustrated by DOBROLYUBOVA. It resembles the first type especially in respect to the morphological nature observed in longitudinal section, while it shows almost similar aspect to the second type in respect to the cross section. Accordingly the present writer was once inclined to regard the Japanese form to be conspecific with '*Fischerina*' *stuckenbergi* DOBROLYUBOVA. However, the internal character of the present form is rather more constant than Russian species; even though some Russian individual shows some resemblance to the Japanese form in cross section, the former is quite different in the nature of the longitudinal section from the Japanese one. If there may be some individuals closely allied to the Japanese form in regard to the longitudinal characters, they are quite distinct from the Japanese form in respect to the nature shown by cross section.

So, the writer is now of the opinion that the difference between the Japanese and the Russian forms is rather greater than he once supposed. Further the Japanese form was collected from the Onimaru series, upper Viséan in age, then it is surely older than the Russian form. The geographical remoteness between the Japanese representative and the Russian one should be also viewed as important in determining the species.

So, the Japanese form should preferably be called by a different name than Russian species; the writer wishes to

propose a new specific name, '*Tschussovskenia? takedai*' for it.

Geological horizon:—Onimaru series.

Locality:—Middle course of Takanosuzawa. Sumita-cho, Iwate Prefecture.

Collector:—H. Takeda.

Registration numbers:—17768, 17777

Genus *Dibunophyllum* Nicholson & Thomson, 1876

Dibunophyllum cf. *bipartitum koninckl* (Edwards & Haime)

Text-figure 7

Compare with: *Dibunophyllum bipartitum koninckl*, Hill. 1938: pp. 75-78, pl. 1, fig. 20; pl. 2; figs. 7-13.

Corallum simple, large, attaining 22 mm in shorter diameter. Epitheca moderately thick and smooth on its outer surface in oblique section. Major septa rather flexuous, moderately thickened by stereoplasmic deposits throughout their length, numbering 48, and most of them so directly unite with the septal lamellae that axial column is hardly differentiated from tabularium. Minor septa nearly absent, but sometimes present although they are very rudimentary in development.

Text-fig. 7
Dibunophyllum cf. *bipartitum koninckl* (Edwards & Haime) (×2)

Dissepimentarium broad, consists of many rows of herringbone dissepiments which turn into pseudoherringbone pattern when minor septa develop near by the epitheca. Dissepiments are disposed more finely in inner side than in the outer side of dissepimentarium. Consequently, sclerothecal wall is formed at the inner surface of dissepimentarium. Slight dilation usually occurs not only in the tabularium but also in the dissepimentarium in which epitheca and dissepiments are thickened as well as in major septa. Cardinal fossula present, and the dissepimentarium in that position is much constricted to the epitheca. Cardinal septum is rather long, accompanying long thin "fossular septa" which do not start from the epitheca, and are situated immediately on both sides of the cardinal one. One of the "fossular septa" directly unites with a thin median plate. Tabularium is very narrow. Axial column is large but not well differentiated from the other parts of corallite, consists of a thin median plate, septal lamellae which are the prolongation of major septa, hence they are in same number as those septa, and many rows of concentric axial tabullae. Median plate straight, falls short at the counter end. Septal lamellae show tendency of rotation, and a number of them do not reach the median plate.

Remarks:—The present form is apparently similar to some species belonging to genus *Clisiophyllum* especially in the aspect of axial column, in which septal lamellae are more or less directly united with the ends of major septa. The

minor septa are much degenerated; the dissepiments of the present form however, are arranged in herringbone pattern though they are mostly arranged concentrically in the genus *Clisiophyllum*. Major septa of the Japanese form also are rather thick even in the dissepimentarium, but this is not the case in usual Clisiophylla. Such being the case the present form would be better assigned to genus *Dibunophyllum* than to *Clisiophyllum*. It must be noted that dissepiments arranged in pseudoherringbone pattern are sometimes developed when minor septa are developed to some extent. The Japanese form now under consideration is almost identical with the specimen described and illustrated by HILL (1938) under the name "*Dibunophyllum bipartitum koninckí*." HILL intended to group many varieties into one species, *Dibunophyllum bipartitum*, and divided it into three subspecies as *D. bipartitum bipartitum, D. bipartitum koninckí* and *D. bipartitum craigianum;* however, the last-named one should be not assigned to genus *Dibunophyllum* but surely belongs to *Rhodophyllum* according to the present writer's view. In fact, there can be very many different individuals in the species designated by HILL as *Dibunophyllum bipartitum* in respect to the axial column. Some individual shows an intermediate nature between genera *Clisiophyllum* and *Dibunophyllum* in regard to the axial column.

The Japanese form may be comparable to such form as *Histiophyllum peachi* THOMSON, in which each septal lamella seems to be an elongation of a major septum, and a thin median plate does not completely bisect the axial column as in Japanese form. Furthermore, partial development of pseudoherringbone dissepiments is also recognizable in THOMSON's species which is now considered to be a form of *Dibunophyllum bipartitum koninckí* defined by HILL.

Under such circumstances, the present Japanese form may perhaps be considered a member of this variable group of *Dibunophyllum bipartitum koninckí*.

The exact horizon of the present form is still unknown. But, according to Mr. KAKIMI's verbal information, the specimen described just above was collected by him in an impure limestone boulder which may come from his *Chaetetes-Lithostrotionella* zone or from a horizon slightly higher than it. At present, this *C–L* zone is termed as H_0 horizon and is considered as a part of *Profusulinella* zone. In Britain, *Dibunophyllum bipartitum koninckí* is found ranging rather widely from D_2 to E_2, that is to say, from upper Viséan to lower Namurian. *Profusulinella* zone in the Nagaiwa series may correspond to the lowest Moscovian in Russian platform. So, the Japanese form might be a late representative of British *Dibunophyllum bipartitum koninckí*.

Geological horizon:—Middle part of the Nagaiwa series, *Profusulinella* zone.

Locality:—Mountain slope northeast of Nagaiwa, Hikoroichi-machi, Ofunato City, Iwate Prefecture.

Collector:—T. KAKIMI.

Registration number:—17648.

Dibunophyllum cf. *asiaticum* MINATO

Text-figure 8

Compare with:

Dibunophyllum vaughani, YÜ, 1934 (non GARWOOD & GOODYEAR, 1924); pp. 128–129, pl. 24, figs. 3a–b.

Dibunophyllum yui MINATO, 1943 (non CHI, 1931); p. 224, pl. 20, figs. 3, 9–11.

Dibunophyllum asiaticum MINATO, 1955 (nom. nov.); pp. 98–100, pl. 8, fig. 1; pl. 10.

Dibunophyllum cf. *asiaticum*, SATO, 1956; pp. 254, pl. 11, figs. 1a–b.

Single thin section which cuts transversely acalical part of a corallite at hand. Corallum simple. Corallite attains about 22 mm in diameter and shows some trigonal outline in transverse section. Epitheca of moderate thickness as well as in major septa. Septa in two orders. Major septa straight or sometimes flexuous, numbering 38, slightly more dilated in tabularium than in dissepimentarium. Most of the major septa do not contact with any axial structure in the present thin section, but that may not be the case in mature part of the corallite which is expected to exist directly below the present thin section. Cardinal fossula prominent, where cardinal septum is much shorter than the other major septa and where the dissepimentarium is also more narrow than in other parts. Minor septa alternating with the major ones, thin, varying in degree of development in the dissepimentarium, but confined always in it and usually attaining to one-third the length of the major. Axial structure comprises, a thick median lamella, a few septal lamellae which are perpendicular to the median lamella and a few axial tabellae. Median lamella intrudes into the cardinal fossula, but there is a fairly good distance between the axial end of the cardinal septum and the cuspidated axial structure. Among the septal lamellae, there are two kinds, long and short ones respectively. Long septal lamellae reach the margin of axial structure, but short ones also originate from the median lamella but never reach the margin. Dissepimentarium not very broad, consists of many rows of herringbone dissepiments which become concentric when minor septa develop. No sclerotheca obseved.

Text-fig. 8
Dibunophyllum cf. *asiaticum* Minato (×2.5)

Remarks:—In 1953, Minato and collaborators synthesized the information on Carboniferous biostratigraphy in the Setamai district of the Kitakami mountain region, which district has been regarded as a type area of the Japanese Carboniferous deposits. In that report, they announced the occurrence of *Clisaxophyllum* sp. from the Onimaru series in their Table 3 of fossil contents of that series. But in 1955, when Minato published an excellent monograph of Japanese Carboniferous and Permian Corals, he neither listed nor described any species of *Clisaxophyllum* among the Onimaru fauna. So, the writer re-examined the specimen once assigned to *Clisaxophyllum* sp., and found that the specimen is nothing but a form of *Dibunophyllum* which has been described just above.

It seems quite possible to the writer that the reason why Minato ignored the occurrence of *Clisaxophyllum* sp. when writing his monograph may lie in this consideration.

For the reason of the scanty material at hand, it is difficult to determine a precise specific name for the present form. Nevertheless, from the character of the herringbone dissepiments, the writer intends to assign the present

form into genus *Dibunophyllum* rather than into genus *Clisaxophyllum*, although the axial structure of the present form surely resembles the axial structure in *Clisaxophyllum*. Among many species of *Dibunophyllum* the present form may be referable to *Dibunophyllum vaughani* which was described by YÜ, and renamed later by MINATO as *Dibunophyllum asiaticum*. This species has less long minor septa, thick major septa especially in tabularium and no sclerotheca at inner margin of the dissepimentarium; and the septal lamellae are perpendicular to the median lamella.

Genus *Clisaxophyllum* is scarcely known in Japanese upper Viséan, while, on the contrary, it is prominent in Chinese Fengninian.

Geological horizon:—Onimaru series.

Locality:—West of Onimaru, Hikoroichi-machi, Ofunato City, Iwate Prefecture.

Collector:—T. KAKIMI

Registration number:—17335

Genus *Amygdalophyllum* DUN & BENSON, 1920

Amygdalophyllum sp. *a*

Amygdalophyllum sp. *a*, MINATO, 1955: pp. 147-148, pl. 5, figs. 2, 3, 5; and 6; pl. 34, fig. 5; pl. 35, fig. 5; pl. 36, figs. 3, 7.

Remarks:—On a previous occasion when MINATO (1955) described the species for the first time, it was not certain from what horizon the present form was yielded, although the appearance of the coral suggested that it might be pre-Onimaru in age.

Now, it has been clarified by the effort of T. HASHIMOTO who once engaged in field survey in Hikoroichi-machi for his graduation thesis in our department. He collected a number of fossil corals, among which the writer found a form of *Amygdalophyllum* which possesses a large columella and is assignable to MINATO's *Amygdalophyllum* sp. *a*.

HASHIMOTO's collection of the present form was made from the Hikoroichi series, Etroeungtian in age. Genus *Amygdalophyllum* is known from several localities and horizons in Asia, Australia and Europe. But no form has been reported from the Etroeungtian. In reality, *Amygdalophyllum etheridgei*, one of the Australian forms, is reported from the upper part of Lower Carboniferous Burindi series, but that part does not necessarily represent the whole deposits of Lower Carboniferous but is understood as an upper Lower Carboniferous formation. So, the present species is the oldest record of the genus in the world. In the Hikoroichi series, there occur several limestone lenses at two horizons in Hikoroichi-Machi. The present form is embedded firmly in one of the lower limestone members in the state of much destroyed fragments; the peripheral parts are usually lost almost wholly. As MINATO once suggested the present form may represent a new species, although it much resembles *Amygdalophyllum etheridgei* DUN & BENSON, the genotype, especially in the point of its intrathecal characters.

Geological horizon:—About 150 m above the basal conglomerate of the Hikoroichi series, Lower Carboniferous.

Locality:—150m southeastward of point 469 near Ohmori, Hikoroichi-machi, Ofunato City, Iwate Prefecture.

Collector:—T. HASHIMOTO.

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PRESIDENTIAL ADDRESS

A PROBLEM ON THE GEOLOGICAL RANGE AND GEOGRAPHICAL DISTRIBUTION OF DESMOSTYLIDS*

HISAKATSU YABE, M. J. A.

Hisakatsu Yabe

The Institute of Geology and Palaeontology, Tôhoku University, Sendai has in its palaeontological collection a molar of *Desmostylus* (Reg. No. 57,239) from the drainage area of the Obirasibetu (a river name by Ainu, formerly transliterated Opiraushpet), Tesio Province, Hokkaido, and once reported by H. MATSUMOTO (1918) as "*Desmostylus* cfr. *japonicus* TOKUNAGA and IWASAKI, left upper second molar. V. L. VANDERHOOF (1937) referred to this specimen as an "unworn lower molar with anterior supernumerary column.

Originally this specimen was procured in 1903 by the present writer, then a student of geology in the University of Tokyo, while acting temporarily as an assistant of the late Denkichi YAMASHITA in an exploratory survey of coal in the Obirasibetu district, of the Hokkaido Colliery and Railway Company (now, Hokkaido Colliery and Steamship Company); it was accidentally unearthed by a party of workmen in one of the left side-valleys of Shimokinebetu-zawa (proper transliteration, Pankekenepet), which is a left confluent of the Obirasibetu, and especially close to a thin-banded alternation of coal and sandstone, there exposed, called by them "Tora no kawa" signifying tiger's fur on its peculiary striped appearance. Unfortunately, at that time the writer had no opportunity to visit personally the actual locality of the fossil.

While the accurate position of the locality of the molar excavated some half a century ago can no more be ascertained, it is now found possible to settle definitely the stratigraphical horizon of the mother-rock of the molar.

In a conference the writer held at Sapporo late the last October with W. HASHIMOTO, S. NAGAO, and K. MATSUNO, three geologists very intimate of the stratigraphy of this district, there were unanimous in the view that the locality of the molar, though its accurate site is unknown, lies certainly within the area of distribution of the Tappu formation, as shown on the Geological Map,

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in the scale of 1:50,000, Sheet Tappu, published by the Geological Survey of Japan (Tsushima, Tanaka, Matsuno and Yamaguchi, 1958), there are no Neogene deposits exposed nearby.

The Obirasibetu molar has its root lost and the base of the crown is filled with a gray compact mudstone. On the writer's request, K. Asano examined this matrix for foraminifera and found in it *Trochammina asagaiensis* Asano which is hitherto known only from the Tappu formation of the Obirasibetu district and the Asagai formation of the Zyôban coalfield in Northeast Honsyu.

The Tappu formation is divided into two parts by the "Tora no kawa": the lower, Simokine sandstone, and the upper, Tappu shale. The Tappu shale looks like the Poronai shale of the Isikari coal-field, both being very similar in general aspect, lithological nature, and megafossils, and was often thought to be the Poronai shale itself; this circumstance led some geologists to the belief of the Simokine sandstone lying beneath the Tappu shale is older than the Poronai shale.

The Simokine sandstone and Tappu shale contain foraminifers; these have already been studied by K. Asano (1956, 1958), who obtained from the former:

Trochammina asagaiensis Asano	abundant
Plectina shimokinensis Asano	common
Elphidium yumotoense Asano	common
Nonion pompilioides shimokinense Asano	common
Elphidium iojimense Asano and Murata	few
Elphidium sumitomoi Asano and Murata	rare
Elphidium cf. *saitoi* Asano and Murata	rare
Cyclammina cf. *incisa* (Stache)	rare
Bulimina yabei Asano and Murata	few
Bulimina pyrula d'Orbigny	rare
Cassidulina margareta Karrer	few

and some others, and from the latter:

Bulimina yabei Asano and Murata	common
Bulimina spp. indet. (much compressed)	common
Cyclammina incisa (Stache)	common
Trochammina asagaiensis Asano	few

and a few others, rare and specifically indeterminable.

Asano stated "*Trochammina asagaiensis* and *Elphidium yumotoense* are characteristic species of the Asagai formation, and *Elphidium iojimense*, *E. sumitomoi*, *E. saitoi* and *Bulimina yabei* are dominant species of the Iojima formation of the Takashima coal-field, Kyushu. Characteristic species of the Poronai shale of the Ishikari coalfield, Hokkaido, *Plectofrondicularia packardi* or *Plectina poronaiensis* are apparently absent in the Shimokine, and in Kyushu they are found in the upper part of the Sakasegawa shale which is stratigraphically situated below the Iojima formation. Thus the writer considers that the Shimokine may be correlated with the Asagai formation of the Joban coalfield or with the Iojima formation of Kyushu and not to the Poronai which should be correlated with the upper part of the Sakasegawa shale of Kyushu" (Asano, 1958, p. 70).

Asano recognized four foraminiferal zones in the Poronai shale, which are as follows, in descending order,

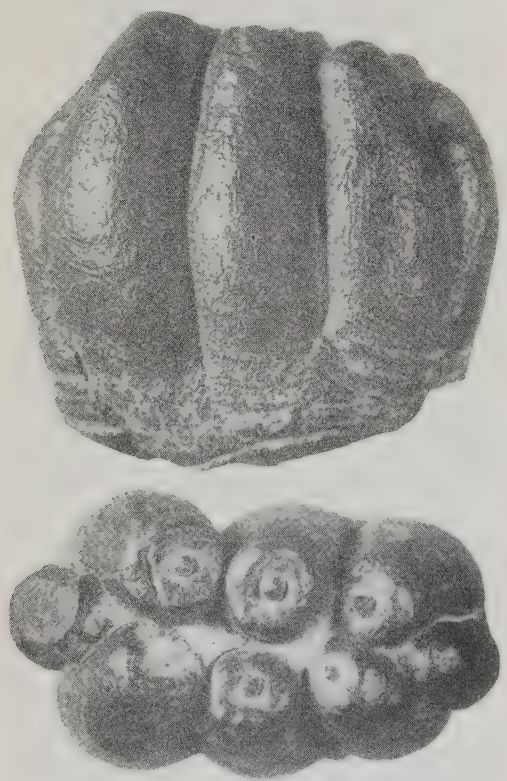
Plectofrondicularia packardi zone
Bulimina ezoensis zone
Cornuspiroides oinomikadoi zone
Nonion sorachiense-Ammobaculites akabiraense zone

The two upper zones are correlated by him to the Lower Oligocene Refugian stage of California, U. S. A., and the Simokine sandstone as well as the

Asagai formation to the Upper Oligocene Zemorrian of the same (Asano, 1958, pp. 45, 47).

The Tappu shale is overlain by the Neiraku formation; they are slightly unconformable, a thin conglomerate layer at the base of the latter covering the uneven surface of the former and often including fragments of shale derived from it. Foraminiferal and molluscan faunas of the Neiraku formation differ distinctly from the corresponding ones of the Tappu formation, the former bearing decidely a Neogene aspect.

In short, the Obirasibetu molar is certainly from the Tappu formation, Upper Oligocene in age. *Desmostylus* already inhabited Hokkaido at this time.



The Obirasibetu molar of *Desmostylus* nat. size; anterior border to the left.

In the west coast of North America, *Desmostylus* is strictly limited, according to VanderHoof, to the Temblor (upper Middle Miocene) and the Briones (lower Upper Miocene). He held that *Desmostylus japonicus* Tokunaga and Iwasaki from Togari, Gifu Prefecture, and *D. mirabilis* Nagao from Keton, Saghalien, specifically not separable from *D. hesperus* Marsh, and the *Desmostylus* horizon of Japan and Saghalien as the time equivalent of the Temblor and Briones of the west coast of North America (VanderHoof, 1937, p. 195) The latter remark may hold good approximately in so far as *D. japonicus* and *D. mirabilis* of the type localities are concerned.

But, in the same year (1937), T. Nagao (1937a) reported on *Desmostylus minor* Nagao based on a right upper second molar found in the Hattyôrei formation of the second tributary of the Asanaizawa, Honto-mati, South Saghalien; this molar is smaller than the corresponding ones of *D. japonicus* and *D. mirabilis*, but otherwise very similar, being likewise hypsodont.

The Tertiary deposits of South Saghalien are divided into, in descending order.

Siretori group
Honto group
Maoka group
Naibuti group

The Naibuti and Maoka groups are approximate equivalents of the Isikari and Poronai groups respectively of the Isikari coalfield (Uwatoko, 1937). The Hattyôrei formation and the underlying Aragai are included by some authors in the Honto group as its lower member and by others in the Maoka group as its upper one; in the mean time, H. Takeda (1953) has shown the Hattyôrei

formation to contain numerous elements of the Poronai molluscan fauna in common with the Aragai and Nissakutan formations, and called these three formations altogether, the "Poronai formation of South Saghalien".

TAKEDA enumerated the following mollusca from the Hattyôrei:

Acila vigilia SCHENCK, *Nuculana ramseyi* (SMITH), *Yoldia laudabilis* YOKOYAMA, *Y. tokunagai* YOKOYAMA, *Y. asagaiensis* MAKIYAMA, *Y. sagittaria* YOKOYAMA, *Y.* sp., *Periploma besshoensis* YOKOYAMA, *Thracia* sp., *Venericardia elliptica* TAKEDA, *V. ezoensis* TAKEDA, *V. expansa* TAKEDA, *Thyasira bisecta* CONRAD, *Paphia munroei* YOKOYAMA, *Liocima fultiva* (YOKOYAMA), *L. tennera* (YOKOYAMA), *Macoma tokyoensis* MAKIYAMA, *M. sejugata* (YOKOYAMA), *Turcicula sakhalinensis* TAKEDA, *Natica* sp., *Turritella nipponica* YOKOYAMA, *T. kiiensis* YOKOYAMA, *Neptunea modestoidea* TAKEDA, *Neopsephaea antiquir* TAKEDA, *Dentalium nunomae* TAKEDA.

The basal part of the Hattyôrei which yielded *Desmostylus minor* is the lower *Desmostylus* or *Desmostylus minor* horizon of Nagao.

The Naihoro coal-bearing formation, the upper division of the Honto group, yielded molars of larger size resembling those of *Desmostylus mirabilis* NAGAO at Ausi near Noda and at the Usu Colliery north of Ausi on the west coast of South Saghalien. The type specimen of this species is from an equivalent formation of Keton, Sisuka-mati, Sisuka-gun on the east coast of the same island. The Naihoro coal-bearing formation is correlated by its molluscan fauna to the Kawabata of Hokkaido.

MINATO et al. (1957) enumerated the following molluscs from the Naihoro formation:

Arca cf. *amicula* YOKOYAMA, *Glycimeris chitanii* ? YOKOYAMA, *Pecten subyessoensis* YOKOYAMA, *Volsella* sp., *Cardium* cf. *shiobarense* YOKOYAMA, *Lucina acutilineata* ? CONRAD, *Pitar okadai* ? (YOKOYAMA), *Paphia* ? aff. *shiratoriensis* OTSUKA, *Dosinia* sp., nov., *Mactra* sp., *Macoma tokyoensis* MAKIYAMA, *Cultellus izumoensis* YOKOYAMA, *Thyasira bisecta* CONRAD, *T. nipponica* YABE et NOMURA, *Mya japonica* JAY, *Buccinum* cf. *sachalinensis* YOKOYAMA, *Cerithium* ? sp. cf. *Cerithidea ishikariensis* YOKOYAMA.

This *Desmostylus* horizon is the Upper *Desmostylus* or *Desmostylus mirabilis* horizon of NAGAO.

These two *Desmostylus* horizons being stratigraphically wide apart, and the molluscan faunas of the two formations Naihoro and Hattyôrei being quite different, NAGAO's view is, the present writer believes, well established, and the only question to be solved in the future is whether the Hattyôrei formation of Saghalien is to be correlated to either of the Poronai or the Tappu of Hokkaido. That the Hattyôrei is the uppermost division of the Maoka group, the "Poronai of South Saghalien" of Takeda, makes the assumption of its contemporaneity with the Tappu more probable than the opposite conception.

Two month later, NAGAO (1937b) recorded another occurrence, this time from Hokkaido, of a small molar of *Desmostylus*, a third molar either of left upper or right lower jaw, as *Desmostylus* cf. *minor*. Found free on the streambed in the upper course of the Okoppe-zawa, some 3 km south of the Kamiatunai Station of the Kusiro railway, its stratigraphical position is unknown; lately, M. MINATO and his associates (1957) expressed their conviction of its probable derivation from the Tyokubetu formation, top member of the Onbetu group, after their detailed study of the geology around the Okoppe-zawa, though without any positive evidence.

The stratigraphical succession of the Palaeogene deposits in the Kusiro coalfield, Kusiro Province, and the Urahoro coalfield, Tokati Province, is as follows, in descending order:

Neogene Honbetu group or younger deposits
—— Unconformable ——
Palaeogene
Onbetu group
Tyokubetu formation (marine)
Nuibetu formation (marine)
Tyaro formation (marine)
Ômagari formation (conglomerate)
Urahoro group
Syakubetu formation (coal-bearing)
Sitakara formation (marine)
Yubetu formation (coal-bearing)
Tenneru formation (coal-bearing)
Harutori (coal-bearing)
Beppu formation (conglomerate)
——Unconformable——
Upper Cretaceous formations (marine)

Asano (1952; 1958, p. 47, tab. 1) found in the Sitakara formation *Cornuspiroides oinomikakoi* Asano and *Cyclammina pacifica* Beck in common with the lower part of the Poronai group, in the Tyaro *Bulimina ezoensis* Yokoyama and *B. schwageri*, and others characterizing the upper part of the Poronai, and in the Nuibetu *Plectfrondicularia packardi* Cushman and Schenck, *P. packardi multilineata* Cushman and Simonson, in addition to the two species of *Bulimina* cited above, an association similar to that in the uppermost Poronai and the overlying Momiziyama formation. From the Tyokubetu formation he knows only *Cyclammina incisa* (Stache).

The Onbetu group, excluding the Tyokubetu at its top, and the Urahoro group of the Kusiro and Urahoro coalfields respectively correspond, according to Asano, to the Upper Poronai plus Momiziyama formations and the lower Poronai plus Isikari groups of the Isikari coalfield. Hence, there is a probability of the Tyokubetu formation occupying nearly the same stratigraphical position with the Tappu formation in the Obirasibetu district, and it makes the inference more or less credible that the Okoppe molar is from the Tyokubetu.

In Hakkaido, there are two other localities of *Desmostylus* teeth namely, Soikosi, Higasi-Setana-mura, and near the Meppu mine, Tosibetu-mura, both in Setana-gun, Siribesi Province. In both cases, the remains were found in the Pirika formation of the Kunnui group; the Pirika formation corresponds to the upper part of the Kawabata in the other parts of Hokkaido.

Desmostylus remains have been reported from many localities geographically widespread in Honsyu, the main island of Japan, extending from the Akita Prefecture in the north to Simane Prefecture in the west; they are not yet found in Sikoku and Kyusyu. All of them are from the Miocene deposits, mostly found above the *Nephrolepidina-Miogypsina* horizon; there is no record until now of the find of *Desmostylus* from Palaeogene rocks in Honsyu.

It is of special interest, that in Japan, *Cornwallius*-like Desmostylid with distinctly brachydont teeth lived almost contemporaneously with *Desmostylus* with hypsodont teeth. *Cornwallius tabatai* Tokunaga (1939) based on two low-crowned teeth, one with a crown composed of 4 columns and an accesory, and a long single root, is from Aikawa on the southwestern coast of the island Sado; they were found in an 8 m thick mudstone directly beneath the *Miogypsina-Operculina* horizon (Hanzawa 1950, p. 80).

Cornwallius ? sp. described by J. Arai (1953) is better known, his material comprising a jaw-bone and six teeth,

probably of one individual. The molars and premolars are low crowned and smaller than the teeth of *C. tabatai* from Sado Island and *C. sookensis* (Cornwall) from Vancouver Island. Its locality is Terao, Odamaki-mura, Titibu-gun, in the Titibu basin, where an excavation was made at a site of the left bank of the upper course of the river Arakawa in a mudstone of the Titibumati formation with *Nephrolepidina*, *Miogypsina kotoi* Hanzawa, and several species of marine molluscs including *Thyasira nipponica* Yabe et Nomura and *Solemya tokunagai* Yokoyama characteristic to the Miocene of Japan.

A nearly complete skeleton of another *Cornwallius*-like Desmostylid was excavated at Inkyoyama, a small hill, of Kuziri, Izumi-mati, Toki-gun, Gihu Prefecture. The study of this skeleton by S. Iziri, T. Shikama and F. Takai has not yet been completed. This material is specially important in the possession first of, brachydont teeth similar to those of *Cornwallius*, secondly of the four pairs of bony thoracic plates in common with the Keton skeleton of *Desmostylus mirabilis* from Saghalien* (Nagao, 1941), and thirdly on account of the stratigraphical level of its mother rook being fairly near to that of the type specimen, which is a skull of *Desmostylus japonicus* (Yoshiwara and Iwasaki, 1902; Tokunaga and Iwasaki, 1914), though their localities are 3 km apart from Togari, Kani-gun, Gifu Prefecture.

The detailed stratigraphy of the Neogene deposits in this and adjacent districts are variously interpreted by different authors; but it is at least so far certain that in broad sense the Izumi skeleton of *Cornwallius* ? and the Togari skull of *Desmostylus japonicus* Tokunaga and Iwasaki are from the same, Togari beds s. l., with numerous marine littoral molluscs, which rest conformably on the Tukiyosi with abundant remains of *Vicarya* and other marine warm water molluscs. The Togari and Tukiyosi beds constitute the Akiyo formation, and are the type of the Miocene Togarian stage of J. Makiyama (1932).

In the foregoing paragraphs, it has been shown (1) that remains of *Desmostylus* occur already in the Upper Oligocene deposits of Japan and South Saghalien, and (2) that these of *Cornwallius* or its near allies and *Desmostylus* occur in Miocene deposits of Japan, in one case in one and the same formation exposed at localities not far apart.

In the west coast of North America,

* The Keton specimen of *Desmostylus mirabilis* was found enclosed in two separate marl nodules lying loose and a few score of meters apart on the streambed of the Hatuyuki-zawa, Keton. The skull enclosed in one of the nodules bears all the features characterizing *Desmostylus*, which is thought to be an aquatic animal like Sirenia, while the leg bones found in association with many other bones in the other nodule are exceedingly stout for an aquatic animal and are those of a pedestrial, digitigrade quadraped with heavy built feet. In consequence, it was sometimes questioned that the skull and the other skeletal parts from two separate nodules really belonged to one and the same animal.

Fortunately there are in the second nodule very peculiar bones, namely thoracic plates of four pairs, in association with the leg bones, etc. These thoracic bones are also provided by the Izumi skeleton with skull intact which bears dentition similar to that of *Cornwallius*. This new find shows that the peculiar thoracic plates are characteristic to Desmostylids, *Desmostylus* and *Cornwallius*, and it is now first confirmed that the skull and other bones of the Keton specimen belong to one individium. (Ijiri, 1952)

Cornwallius (HAY, 1924) is known only from the Sooke formation of Vancouver Island, which is correlated by J. W. DURHAM (1944, p. 113) to the *Echinophoria apta* zone (the upper part of the Blakeley formation of Washington), and the geological range of *Desmostylus* is restricted to the Temblor and Briones of California and equivalent Astoria formation of Oregon. VANDERHOOF thought that the Upper Oligocene *Cornwallius* with brachydont teeth is probably ancestral to the Miocene *Desmostylus* with hypsodont teeth, and imagined the westward migration of the latter from the west coast of North America to the Asiatic coast. These two conclusions of VANDERHOOF now seem difficult to be upheld on the geological evidences in Japan cited above. On the contrary, it is more plausible (1) that *Cornwallius* and *Desmostylus*, both having a geological range from the Upper Oligocene to the Miocene, may represent two parallel lines of descent from a certain unknown ancestral form earlier than Upper Oligocene, and further (2) that *Desmostylus* migrated eastward from the Asiatic coast to the American side and *Cornwallius* westward from the latter to the former.

No remains of Desmostylid have been found in the post-Miocene deposits of the Japanese Islands and the west coast of North America; apparently the phyllum seems to have been extinguished from the world at the end of the Miocene, unless *Cryptomaston martini* VON KOENIGSWALD from the Pleistocene of Java is its younger representant, what denied by VON KOENIGSWALD (1933). This author maintained its alliance to the Probosidea, while H. F. OSBORN referred to it as ? Sirenia.

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PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

「日本古生物学会昭和 33 年度年会」は 1958 年 12 月 6 日および 7 日東京大学理学部地質学教室において開催した。(参会者 88 名) 年会における報告・議事・講演者並びに講演題目は次の通りである。

特別講演

1. ヘーレン国際石炭系会議に出席して..藤本治義
2. 1958 年改正動物命名規約の解説.....槇山次郎

年会

会計, 事業報告及び議事

前会長講演

A Problem on the Geological Range and Geographical Distribution of Desmostylids.....Hisakatsu YABE

学術講演

1. On *Minetaxites ushioi* gen. et sp. nov. with Special Considerations of its male Fructifications from the Mine Group (Upper Triassic) in Yamaguchi Prefecture, Japan.....Enzô KONNO and Gentarô NAITO
2. Our Maceration Technique for Obtaining Spores from Sporangium ..... Enzô KONNO and Kazuo ASAMA
3. Micropaleobotanical Studies on the Mesozoic Coals and Shales from Japan ..... Misaburo SHIMAKURA
4. On the Respiratory Roots of *Taxodium* from the Lignite Bed at the Noto Peninsula, Inner-side of Central Japan .....Hidekuni MATSUO and Norio FUJI
5. On the Pliocene Florule from the Katsuyama City, Fukui Prefecture, Inner-side of Central Japan ..... Hidekuni MATSUO
6. Permian Fusulinids from Central Thailand .....Ryuzo TORIYAMA and Tomomitsu SUGI
7. Upper Cretaceous Foraminifera from Nemuro Peninsula, Eastern Hokkaido, Japan.....Saburo YOSHIDA (代読)
8. Corallum Growth of the Halysitidae.. ..... Takashi HAMADA
9. Gotlandian Shelly Fauna from South-

west Japan (1), *Coronocephalus kobayashii*, New Species from the Kuraoka District, Kyushu..... Takashi HAMADA

10. Two New Permian Corals from Yamaguchi Prefecture.... Michihiro KAWANO
11. Permian Amygdalophylloid Corals from the Kantô Mountainland ..... Toshihiko SATO
12. *Nagatophyllum satoi* OZAWA と *Millerella* と共存する事実について .....村田正文
13. Jurassic Hexacorals from the Shiriya District, Aomori Prefecture, Northeast Japan ..... Motoki EGUCHI and Yoshio ONUKI
14. 北海道足寄町上足寄産六射珊瑚類について .....江口元起・橋本 亘
15. 北海道北見国相ノ内産層孔虫類について .....橋本 亘
16. "*Bakevellia*" and "*Edentula*" from the Late Triassic Mine Series in West Japan .....Akira TOKUYAMA
17. Some Pelecypods from the Tsukinoura Formation near Kodaijima in Miyagi Prefecture, Northeast Japan ..... Itaru HAYAMI
18. Some Pelecypods from the upper Aratozaki Formation in Miyagi Prefecture, Northeast Japan, including a New Genus *Kobayashites*.....Itaru HAYAMI
19. Some Pelecypods from the Upper Jurassic Sakamoto Formation in Central Kyushu, Japan ....Minoru TAMURA
20. On some Triassic Ammonites from the Isatomae Formation ..... Yoshio ONUKI and Yuji BANDO
21. 北海道東部の上部白亜系より *Pachydiscus subcompressus obsoletus* MATSUMOTO の発見とその地質学的意義....吉田三郎（代読）
22. Upper Cretaceous Ammonites of California, Part 1, Baculitidae ....Tatsuro MATSUMOTO
23. The Molluscan Fauna from "the Misaka Formation" of the Tanzawa Mountainland .....Saburo KANNO
24. 仙台付近中新統産 Pectinidae, その 16 *Pecten kimurai* YOKOYAMA について .... 増田孝一郎
25. 仙台付近中新統産 Pectinidae, その 17 総括 ..... 増田孝一郎
26. Pliocene Mollusca from the Northern Margin of the Kitakami Mountains .. .. Kiyotaka CHINZEI
27. An Interpretation of the Paleoecology of the Miocene Kadonosawa Fauna.. ..... Kiyotaka CHINZEI
28. *Callista chinensis* (HOLTEN) の計測について .....牧野 融
29. 千葉県木更津市桜井の崖から産する化石軟体動物群集について .....牧野 融
30. An Eocene Nautiloid from Kyushu.... Teiichi KOBAYASHI and Yasuhiko KAMADA
31. Bio- Thanato- and Fossil-History of *Eutrephoceras japonicum* ..... Teiichi KOBAYASHI and Yasuhiko KAMADA
32. 日本における Ostracoda の研究 ..花井哲郎
33. 三浦半島産 *Palaeopneustes* について..... .....橋本 亘・柴田松太郎
34. Two Fossil Spatangoid Echinoids from Japan .....Matsutaro SHIBATA
35. 泰国 Angthong 産 *Cuon* について..高井冬二

日本古生物学会例会通知

	開催地	開催日	講演申込締切日
第73回例会	九州大学	1959年5月23日	1959年4月30日
第74回例会	京都大学	1959年10月18日	1959年9月25日

講読御希望の方は本会宛御申込下さい

会則変更

1958年12月6日東京大学において開催された日本古生物学会総会において次のように会則が改正された.

第17条より第23条までをれそぞれ第18条より第24条に繰さげ, 第17条に次の条文を挿入する.

第17条本会には名誉会長を置くことができる. 名誉会長は評議員会が推薦し, 総会の決議によって定める. 名誉会長は評議会に参加することができる.

出版規定変更

投稿規定第11項中の別刷部数50部を100部に変更する.

会員消息

会員 湊正雄君は Sweden, Stockholm の Geologiska Institutet に招聘され昨年12月中旬出発した。

会員 金谷太郎君は U.S.A., Scripps Institution of Oceanography に招聘され本年1月上旬出発した。

会員 松沢勲君は欧米視察旅行を終え本年2月上旬帰国した。

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日本古生物学会会則

(1958年12月6日総会にて改正)

第1条　本会は日本古生物学会という。

第2条　本会は古生物学およびこれに関係ある諸学科の進歩および普及を計るのを目的とする。

第3条　本会は第2条の目的を達するため次の事業を行う。

1. 会誌そのほかの出版物の発行。
2. 学術講演会の開催。
3. 普及のための採集会・講演会そのほかの開催。

第4条　本会の目的を達するため総会の議を経て本会に各種の研究委員会を置くことができる。

第5条　本会は古生物学およびこれに関係ある諸学科に興味を持つ会員で組織する。

第6条　会員を分けて普通会員・特別会員・賛助会員および名誉会員とする。

第7条　普通会員は所定の入会申込書を提出した者につき評議員会の議によって定める。

第8条　特別会員は本会に10年以上会員であり古生物学について業績のあるもので，特別会員5名の推薦のあったものにつき評議員会の議によって定める。

第9条　賛助会員は第2条の目的を賛助する法人で評議員会の推薦による。

第10条　名誉会員は古生物学について顕著な功績のある者につき評議員会が推薦し，総会の決議によって定める。

第11条　会員は第12条に定められた会費を納めなければならない。会員は会誌の配布を受け第3条に規定した事業に参加することができる。

第12条　会費の金額は総会に計って定める。会費は普通会員年600円，特別会員年1,000円，賛助会員年10,000円以上とする。名誉会員は会費納入の義務がない。在外の会員は年3弗とし会誌および特別出版物の配布を受ける。

第13条　本会の経費は会費・寄付金・補助金などによる。

第14条　会費を1ヶ年以上滞納した者および本会の名誉を汚す行為のあった者は，評議員会の議を経て除名することができる。

第15条　本会の役員は会長1名，評議員15名とし，うち若干名を常務委員とする。任期は総て2年とし再選を妨げない。
会長の委嘱により本会に幹事および書記若干名を置くことができる。
常務委員は評議員会において互選される。評議員は特別会員の中から会員の通信選挙によって選出される。

第16条　会長は特別会員の中から評議員会において選出され，本会を代表し会務を管理する。
会長に事故ある場合は会長が臨時に代理を委嘱する。

第17条　本会には名誉会長を置くことができる。名誉会長は評議員会が推薦し総会の決議によって定める。名誉会長は評議委員会に参加することができる。

第18条　本会は毎年一回定例総会を開く。その議長には会長が当り本会運営の基本方針を決定する。
総会の議案は評議員会が決定する。
会長は必要があると認める時は臨時総会を召集する。総会は会員の十分の一以上の出席をもって成立する。
会長は会員の三の分一以上の者が会議の目的たる事項および召集の理由を記載した書面をもって総会召集の請求を受けた場合は臨時総会を召集する。

第19条　総会に出席しない会員は他の出席会員にその議決権の行使を委任することができる。但し，欠席会員の議決権の代行は1人1名に限る。

第20条　総会の議決は多数決により，可否同数の時は議長がこれ決める。

第21条　会長および評議員は評議員会を組織し，総会の決議による基本方針に従い運営要項を審議決定する。

第22条　常務委員は常務委員会を組織し評議員会の決議に基づいて会務を執行する。

第23条　本会の会計年度は毎年1月1日に始まり12月31日に終る。

第24条　本会会則を変更するには総会に付議し，その出席会員の三分の二以上の同意を得なければならない。

付　則　1) 評議員会の議決は総て無記名投票による。